This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

HARVARD
MEDICAL LIBRARY

IN THE
Francis A. Countway
Library of Medicine
BOSTON

DR. STANLEY

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No.

DECEMBER, 1916

TRANSACTIONS OF A SPECIAL CONFERENCE OF STATE AND TERRITORIAL HEALTH OFFICERS WITH THE UNITED STATES PUBLIC HEALTH SERVICE, FOR THE CONSIDERATION OF THE PREVENTION OF THE SPREAD OF POLIOMYELITIS

HELD AT WASHINGTON, D. C.
AUGUST 17 AND 18, 1916

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 83
DECEMBER, 1916

TRANSACTIONS OF A SPECIAL CONFERENCE OF STATE AND TERRITORIAL HEALTH OFFICERS WITH THE UNITED STATES PUBLIC HEALTH SERVICE, FOR THE CONSIDERATION OF THE PREVENTION OF THE SPREAD OF POLIOMYELITIS

HELD AT WASHINGTON, D. C.
AUGUST 17 AND 18, 1916

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

ADDITIONAL COPIES
OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
15 CENTS PER COPY

CONTENTS.

	Page.
Telegram c nference	4
Provisional gram	4
List of speakers	5
Morning session, first day	9
Delegates present	9
Address of Secretary of the Treasury	11
Reports of State delegates	13
Report from New York City	25
Afternoon session, first day	48
Symptomatology of poliomyelitis	48
Prevention of interstate spread	56
Research problems	61
Epidemiology	66
Principles of control	77
Morning session, second day	85
Relation of community to aftercare	85
Report of committee on uniform methods of collecting statistics	89
Report accepted	101
Report of committee on prevention of interstate and intrastate spread	104
Report accepted	125
Afternoon session, second day	127
Report of committee on prevention of the spread of poliomyelitis in the home	128
Report accepted	143

TELEGRAM CALLING THE CONFERENCE.

The following telegram was addressed to the health authorities of the States, Territories, and the District of Columbia:

TREASURY DEPARTMENT,
BUREAU OF THE PUBLIC HEALTH SERVICE,
Washington, August 9, 1916.

Under authority public-health law 1902 conference of State and Territorial health authorities with Public Health Service is called to meet this office 10 a. m. Thursday, August 17, to consider poliomyelitis situation and bring about greater uniformity in methods of control. Representation of your State urgently requested. Wire name of delegate.

A. H. GLENNAN,
Acting Surgeon General.

PROVISIONAL PROGRAM.

Opening remarks by the Acting Surgeon General.
Address by the Secretary of the Treasury.
Roll call of delegates.
The poliomyelitis situation in the various States.
The prevention of the interstate spread of poliomyelitis.
Research problems in poliomyelitis.
The symptomatology of poliomyelitis.
The epidemiology of poliomyelitis.
The general principles of control.
The relation of the community to the after-care of poliomyelitis patients.

LIST OF SPEAKERS.

REPORTS OF STATE DELEGATES.

Remarks by—	Page.	Remarks by—	Page.
Dr. A. H. Glennan, chairman	10	Dr. F. A. Cooney	23
Dr. W. C. Rucker, secretary	13	Dr. E. A. Carr	24
Dr. Glenn Andrews	13	Dr. I. A. Watson	24
Dr. C. W. Garrison	13	Dr. R. D. Fitz-Randolph	25
Dr. Guy E. Manning	14	Dr. George Draper	25
Dr. S. R. McKelvey	14	Dr. W. S. Rankin	33
Dr. John T. Black	15	Dr. F. G. Boudreau	34
Dr. W. P. Orr	15	Dr. D. N. Roberg	34
Dr. W. C. Woodward	16	Dr. Samuel G. Dixon	35
Dr. J. Y. Porter	45	Dr. G. T. Swarts	37
Dr. C. St. Clair Drake	16	Dr. J. A. Hayne	39
Dr. W. F. King	17	Dr. E. B. Jenkins	40
Dr. Henry Albert	17	Dr. H. H. Shoulders	40
Dr. J. N. McCormack	18	Dr. W. B. Collins	40
Dr. A. G. Young	19	Dr. H. A. Ladd	41
Dr. John F. Fulton	20	Dr. E. G. Williams	43
Dr. Allan J. McLaughlin	21	Dr. T. D. Tuttle	43
Dr. John L. Burkart	21	Dr. C. R. Weirich	44
Dr. H. M. Bracken	22	Dr. C. A. Harper	44
Dr. J. A. B. Adcock	23	Dr. Oscar Dowling	47

REPORTS FROM CITY DELEGATES.

Remarks by—	Page.
Dr. Haven Emerson	25

SYMPTOMATOLOGY OF POLIOMYELITIS.

Remarks by—	Page.	Remarks by—	Page.
Dr. George Draper	48	Dr. A. G. Oppenheimer	53
Dr. A. E. Frantz	52	Dr. E. M. Parlett	54
Dr. Haven Emerson	53	Dr. W. H. Frost	54
Dr. Arthur T. Wolff	53		

PREVENTION OF INTERSTATE SPREAD.

Remarks by—	Page.	Remarks by—	Page.
Dr. Charles E. Banks	56, 61	Dr. T. D. Tuttle	57, 61
Dr. H. M. Bracken	57, 61	Dr. John L. Burkart	57

PREVENTION OF INTERSTATE SPREAD—Continued.

Remarks by—	Page.	Remarks by—	Page.
Dr. E. A. Carr	58	Dr. Haven Emerson	59
Dr. D. N. Roberg	58	Dr. W. C. Woodward	61
Dr. John S. Fulton	58		

RESEARCH PROBLEMS.

Remarks by—	Page.	Remarks by—	Page.
Dr. C. H. Lavinder	62	Dr. H. M. Bracken	64
Dr. G. W. McCoy	63	Dr. C. St. Clair Drake	64
Dr. W. S. Rankin	64	Dr. Haven Emerson	64

EPIDEMIOLOGY OF POLIOMYELITIS.

Remarks by—	Page.	Remarks by—	Page.
Dr. W. H. Frost	66	Dr. W. B. Collins	74
Dr. Samuel G. Dixon	71	Dr. A. G. Oppenheimer	75
Dr. W. C. Woodward	71	Dr. A. G. Young	75
Prof. C. W. Stiles	72	Dr. C. St. Clair Drake	75
Dr. Arthur T. Wolff	72	Dr. W. C. Woodward	75
Dr. T. D. Tuttle	73	Dr. E. M. Parlett	76
Dr. J. P. Leake	73	Dr. W. B. Garrison	77
Dr. J. Y. Porter	73	Dr. Allan J. McLaughlin	77
Dr. A. E. Frantz	74		

PRINCIPLES OF CONTROL.

Remarks by—	Page.	Remarks by—	Page.
Dr. Haven Emerson	77	Dr. W. H. Frost	82
Dr. H. M. Bracken	79	Prof. C. W. Stiles	83
Dr. Henry Albert	80	Dr. A. E. Frantz	83
Dr. J. A. Hayne	80	Dr. E. A. Carr	84
Dr. J. N. McKelvey	81	Dr. Allan J. McLaughlin	84
Dr. G. T. Swarts	81	Dr. J. W. Trask	84
Dr. A. G. Young	82	Dr. J. Y. Porter	84
Dr. W. C. Woodward	82, 85		

RELATION OF THE COMMUNITY TO AFTERCARE.

Remarks by—	Page.	Remarks by—	Page.
Dr. Henry Albert	85	Dr. E. A. Carr	88
Dr. W. S. Rankin	86	Dr. G. T. Swarts	88
Dr. Arthur T. Wolff	87	Dr. H. A. Ladd	89
Dr. J. Y. Porter	87		

REPORT OF COMMITTEE ON UNIFORM METHODS OF COLLECTING STATISTICS.

Remarks by—	Page.	Remarks by—	Page.
Dr. C. H. Lavinder	89, 94	Dr. W. S. King	94, 97
Dr. Arthur T. Wolff	92	Dr. C. St. Clair Drake	94
Dr. Frederick L. Hoffman	92	Dr. G. T. Swarts	94
Dr. W. S. Rankin	92	Dr. W. C. Woodward	95, 98
Dr. A. G. Young	92	Dr. John L. Burkart	99
Dr. J. W. Trask	92	Dr. D. N. Roberg	93
Dr. John T. Black	93		

REPORT OF COMMITTEE ON PREVENTION OF INTERSTATE AND INTRASTATE SPREAD.

Remarks by—	Page.	Remarks by—	Page.
Dr. J. S. Fulton	104, 109, 113	Dr. C. St. Clair Drake	107
Dr. W. B. Collins	106	Dr. Oscar Dowling	112
Dr. John T. Black	107	Dr. W. H. Frost	112
Dr. John L. Burkart	106	Dr. W. S. Rankin	114
Dr. G. T. Swarts	107	Dr. Frederick L. Hoffman	114
Dr. Charles E. Banks	108, 115	Dr. J. P. Leake	114, 121
Dr. H. M. Bracken	108, 117	Dr. E. M. Parlett	117
Dr. T. D. Tuttle	108	Dr. E. A. Swarts	117
Dr. A. G. Young	108	Dr. F. G. Boudreau	117
Dr. J. W. Kerr	109, 116	Dr. E. G. Williams	118
Dr. J. Y. Porter	110	Prof. C. W. Stiles	123
Dr. J. W. Trask	110	Dr. C. W. Garrison	125
Dr. W. C. Woodward	113, 115		

REPORT OF COMMITTEE ON PREVENTION OF THE SPREAD OF POLIOMYELITIS IN THE HOME.

Remarks by—	Page.	Remarks by—	Page.
Dr. C. St. Clair Drake	128, 139	Dr. D. N. Roberg	137
Dr. E. A. Swarts	131	Dr. Charles E. Banks	136
Dr. W. S. Rankin	131, 148	Dr. J. Y. Porter	136, 145
Dr. W. B. Collins	131	Dr. E. G. Williams	138
Dr. John L. Burkart	132	Dr. A. G. Young	141
Dr. H. M. Bracken	132	Dr. Arthur C. Levy	143
Dr. Glenn Andrews	133	Dr. Henry Albert	145
Dr. W. C. Woodward	133, 140	Dr. S. R. McKelvey	147
Dr. Oscar Dowling	134		

TRANSACTIONS

OF A

SPECIAL CONFERENCE OF STATE AND TERRITORIAL HEALTH AUTHORITIES WITH THE UNITED STATES PUBLIC HEALTH SERVICE

FOR THE CONSIDERATION OF THE

PREVENTION OF THE SPREAD OF POLIOMYELITIS.

MORNING SESSION, AUGUST 17, 1916.

The conference was called to order at 10.15 o'clock a. m. by the chairman, Acting Surg. Gen. A. H. Glennan, the following being present:

REPRESENTATIVES OF THE PUBLIC HEALTH SERVICE.

Asst. Surg. Gen. W. G. Stimpson.
Asst. Surg. Gen. J. W. Kerr.
Asst. Surg. Gen. W. C. Rucker, secretary.
Asst. Surg. Gen. R. H. Creel.
Asst. Surg. Gen. J. W. Trask.
Senior Surg. C. E. Banks.
Surg. Hugh Cumming.
Surg. L. E. Cofer.
Surg. C. H. Lavinder.
Surg. G. W. McCoy.
Surg. B. S. Warren.
Surg. A. M. Stimson.
Passed Asst. Surg. W. H. Frost.
Passed Asst. Surg. J. P. Leake.
Passed Asst. Surg. W. F. Draper.
Prof. C. W. Stiles.

STATE DELEGATES.

Alabama, Dr. Glenn Andrews.
Arizona, Dr. E. P. Palmer.
Arkansas, Dr. C. W. Garrison.
California, Dr. Guy E. Manning.
Colorado, Dr. S. R. McKelvey.
Connecticut, Dr. John T. Black.
Delaware, Dr. W. P. Orr.
District of Columbia, Dr. W. C. Woodward.
Florida, Dr. J. Y. Porter.
Illinois, Dr. C. St. Clair Drake.
Indiana, Dr. W. F. King.
Iowa, Dr. Henry Albert.
Kentucky, Dr. J. N. McCormack.
Louisiana, Dr. Oscar Dowling.
Maine, Dr. A. G. Young.
Maryland, Dr. John S. Fulton.
Massachusetts, Dr. A. J. McLaughlin.
Michigan, Dr. John L. Burkart.
Minnesota, Dr. H. M. Bracken.
Missouri, Dr. J. A. B. Adcock.
Montana, Dr. F. A. Cooney.
Nebraska, Dr. E. A. Carr.
New Hampshire, Dr. I. A. Watson.
New Jersey, Dr. R. D. Fitz-Randolph.
New York, Dr. George Draper.
North Carolina, Dr. W. S. Rankin.
Ohio, Dr. F. G. Boudreau.
Oregon, Dr. D. N. Roberg.
Pennsylvania, Dr. S. G. Dixon.
Rhode Island, Dr. G. T. Swarts.
South Carolina, Dr. J. A. Hayne.
South Dakota, Dr. E. B. Jenkins.
Tennessee, Dr. H. H. Shoulders.
Texas, Dr. W. B. Collins.
Vermont, Dr. H. A. Ladd.
Virginia, Dr. E. G. Williams.
Washington, Dr. T. D. Tuttle.
West Virginia, Dr. C. R. Weirich.
Wisconsin, Dr. C. A. Harper.

GUESTS.

Dr. Haven Emerson, commissioner of health, New York City.
Dr. W. W. Ford, associate professor of hygiene, Johns Hopkins University.
Dr. John D. Blake, health commissioner of Baltimore.
Dr. J. D. Hagard, South Boston, Va.
Dr. Ernest C. Levy, chief health officer, Richmond, Va.
Dr. Arch Cheatham, Durham, N. C.
Dr. J. Mitchell Reese, Phillipsburg, N. J.
Dr. T. F. Abercrombie, Brunswick, Ga.
Dr. Thomas Reid Crowder, superintendent of sanitation, Pullman Car Co., Chicago, Ill.
Dr. Arthur T. Wolff, Connecticut State board of health, Hartford, Conn.
Dr. William Egleston, South Carolina board of health.
Dr. A. J. Wheeler, representing Office of Indian Affairs, Washington, D. C.
Dr. James D. Love, Jacksonville, Fla.
Dr. B. M. Little, Clarksville, Tenn.
Mr. Tolley A. Blays, Maryland.
Mr. Mosby G. Perrow, Lynchburg, Va.
Dr. Arthur M. Wright, Erie Railroad, New York City.
Mr. W. C. Hope, general passenger agent Central Railroad of New Jersey, New York City.
Mr. E. R. Scoville, Baltimore & Ohio Railroad Co.
Dr. D. Z. Dunott, Western Maryland Railroad Co.
Dr. E. M. Parlett, Baltimore & Ohio Railroad Co.
Mr. N. S. Burns, Pittsburgh, Pa.
Dr. G. N. Thomas, representing El Paso County and El Paso city, Tex.
Mr. E. B. Hunt, superintendent relief department, Pennsylvania Railroad.
Dr. W. A. Applegate, chief surgeon Southern Railway, Washington, D. C.
Dr. J. M. Wainwright, chief surgeon Delaware, Lackawanna & Western Railroad.
Mr. S. B. Hege, district passenger agent Baltimore & Ohio Railroad, Washington, D. C.
Dr. A. G. Oppenheimer, Chesapeake & Ohio and Richmond, Fredericksburg & Potomac Railroads, Richmond, Va.
Mr. C. F. Smith, general superintendent passenger transportation New York Central, New York City.
Mr. Charles C. Pauling, solicitor New York Central Railroad, New York City.
Dr. Frederick L. Hoffman, Prudential Insurance Co., Newark, N. J.

The CHAIRMAN. This conference is called in accordance with the act of Congress of July 1, 1902, to consider the prevalence at the present time of poliomyelitis and to discuss with you, as representatives of the health organizations of the various States, ways and means of preventing its spread. In opening the conference I wish to state that Surg. Gen. Blue is incapacitated by an attack of sciatica, and will therefore be unable to be present. He wishes me to express to the conference his sincere regret at his enforced absence and to assure the delegates of his deep interest in the subject under consideration.

We have the honor of having with us this morning the Hon. William G. McAdoo, Secretary of the Treasury, to whom I might apply in addition the title of Secretary of Public Health. [Applause.] Since the beginning of the present outbreak of poliomyelitis he has taken deep interest in the situation. I take great pleasure in presenting to you Secretary McAdoo. [Applause.]

ADDRESS OF SECRETARY M'ADOO.

Secretary McAdoo. Dr. Glennan and gentlemen, I welcome you heartily to Washington. I wish that the occasion of your visit were something less serious than the subject that calls you here. We are facing another epidemic of infantile paralysis—that baffling and mysterious disease which has brought so much woe to New York City and has thus far proven itself beyond the control of science. We have had as a natural consequence of a mysterious and deadly epidemic of this sort a great deal of alarm and a great deal of hysteria in some places. This has resulted in all kinds of regulations by State and local authorities, resulting in a great variety and form of effort to prevent the spread of the disease. The purpose of these regulatory measures is in the highest degree commendable, but without some sort of a uniform direction—cool-headed direction—our efforts will be less effective than they ought to be, and unnecessary inconvenience will inevitably be placed upon the public. Now, the Public Health Service, which has a very definite function under the national authority, is trying to exercise its powers in cooperation with the powers exercised by the health authorities of the different States in order that a more coordinated and effective effort may be made to fight the mysterious enemy. We have asked you to come here for the purpose of exchanging views, and after a calm and well-considered discussion, of determining what is the most intelligent and useful thing to do in the circumstances.

My experience with panics—we have had to approach very near to some of them since I have been in the Treasury Department, panics not occasioned by the presence of physical disease, but mental disease of a financial sort—has led me to realize the importance of cooperative effort, of intelligent discussion of problems with a view to ascertaining what the real problems are, and then, like commonsense and courageous people, taking them up and trying to find a solution for them.

I have great confidence in this conference. I am so naturally a believer in the efficacy of human effort that I never look at things as impossible. I am unwilling to admit that anything is impossible that is within the range of human effort, and I have great hopes therefore that you are going to be able, as a result of these delibera-

tions, to concert immediate measures for better and more effective cooperation between the different communities of the United States, develop a better understanding of the difficult problem before us, and devise measures that will confer a minimum of inconvenience and a maximum of benefit upon the public. That is what we are striving to do, so far as the regulatory features are concerned, and I recommend to you gentlemen a thorough consideration of these phases of the problem.

Now, the other side of the problem is scientific. With regard to that I have no suggestions to offer, because you men of science know better how to deal with it than I do. But I am exceedingly hopeful that as a result of the exchange of ideas here you may get additional light upon this subject, and that you may at least be able to concert new measures and investigations that will give promise of the discovery soon of a remedy for this deadly disease, so that it may be removed as a menace to the human race.

I have great respect for the noble profession you gentlemen represent, and I wish to say to you that among the many activities of the Treasury Department no one of them appeals to me more strongly than the Public Health Service. It has potentialities of the utmost importance to the American people. I believe that, great as the service it has already performed, it can be made an even more effective instrument in the service of the people of this country than it has already been. In saying that I do not mean that an enlargement of its powers is going to bring it into conflict with the proper powers of the States, but, on the contrary, we can make the national instrument a far more effective agency of cooperation with the State health authorities than it is at the present time. I believe I may claim, without exaggeration, that under Surg. Gen. Blue's administration—and I hope that I have been able to further it to some extent myself—the Public Health Service is to-day performing a larger and more useful service to the American people than it ever has done before.

So I welcome you, gentlemen; I welcome you most heartily to this city, and I assure you that the services of the Treasury Department are placed unreservedly at your disposal, and that you can depend upon the unlimited cooperation of this department in the noble work you have undertaken.

Gentlemen, I am sorry I can not stay with you. I do not know anything that would please me more than to take part in your deliberations, but unfortunately I am under very great pressure, and I have so many other things to do that I must leave you now and look after other matters. [Applause.]

The CHAIRMAN. The secretary of the conference will now call the roll of States.

(The secretary here called the roll of States.[1])

The SECRETARY. Those who are guests of the conference will please write their names and addresses and deliver them to the secretary, writing at the top of the paper the word "guest."

The CHAIRMAN. I wish to announce that the official delegates only have the right to vote. Later we will be glad to extend the privileges of the floor to our guests. We have quite a number of them.

This is a tentative program and is subject to change at any time so that we may get along with the business in hand. The first subject is "The poliomyelitis situation in the various States." It seems to me it would be well to have the secretary call the roll, and as each representative's name is called, let him make a short statement of the poliomyelitis situation in his State. Remarks on this head are limited to 5 minutes. The secretary will call the roll.

The SECRETARY. Dr. Glenn Andrews, of Alabama.

Dr. ANDREWS. You want the condition just as it is now, Mr. Chairman?

The CHAIRMAN. Just give us an idea of the conditions in your State—the present conditions.

Dr. ANDREWS. We did not have poliomyelitis reported upon, except along with other diseases, until after this outbreak in New York. Since then we have had special reports. On July 13 the State board of health sent out a notice to the county health officers requiring that infantile paralysis be reported instantly in every case by telegraph. We require all contagious diseases to be reported by mail. Poliomyelitis was ordered to be reported by telegraph. From July 13 to 24, inclusive, 77 cases were reported from 17 counties. From August 1 to August 14 there have been reported 17 cases in five additional counties, making 94 cases reported in 22 counties. One county, Jefferson, has reported a total of 24 cases. The number of cases from other counties has varied from 1 to 3.

Before this year we have had cases of infantile paralysis reported with other diseases. Last year there were reported 24 deaths for the entire year, which at the rate of 1 death to 10 cases would be about 240 cases in the State. The cases this summer thus far have been widely scattered. I have brought with me a map outlining the location of the disease, and with the exception of one county, Jefferson, there has been no appreciably large number of cases. That county, which is the largest in the State, shows 24 cases, and you will see how widely scattered the disease has been. [I will leave that map with you.]

The SECRETARY. Dr. C. W. Garrison, of Arkansas.

[1] The list of those present is given on page 9.

Dr. GARRISON. Mr. Chairman, I have been out of the State for three weeks, but up to the time I left there we had had three cases, one in the southwest section of the State and two in the northeast.

About four years ago Arkansas had an epidemic of poliomyelitis in the southwestern part of the State, with 150 to 200 cases, and the Public Health Service made an investigation. The board has been watching the reports, but the three cases only having been notified, no special action has been taken.

The SECRETARY. California; Dr. Guy E. Manning.

Dr. MANNING. California has to report two cases. We have had endemic cases in the State in previous years, but under supervision of the city and State authorities the spread of the disease has been prevented. This year we have had, since the epidemic was reported in the East, four cases, one in San Francisco, which was not diagnosed on the train, but which was afterwards found to have come from New York, reaching California in about six days after it had left there, coming direct. This case proved to be a true case of poliomyelitis. It was taken in hand by the health authorities and quarantined, and from that case there has been no spread.

A few miles from there by rail there has been another case reported. That also came from outside of the State. In the southern part of the State there have been two cases. So I think four cases will cover all that we have to-day. These cases have all, of course, come from other States, so that while we do not fear the spread of poliomyelitis, we are watching conditions very closely. California is entered by four lines of railroad, and all of these connect with almost all eastern points. Inspection has been established at the boundary lines of the State, all children being inspected before they are allowed to enter.

The SECRETARY. Colorado; Dr. S. R. McKelvey.

Dr. MCKELVEY. Mr. Chairman, Colorado requires the immediate reporting of all communicable diseases, which, of course, includes poliomyelitis. During the present year there have been only four cases reported, and we have been unable to trace the origin of any of these cases to the East. They are probably sporadic cases, without any actual indication as to just where they may have had their origin. One of these cases was in a western county in the State, near the Utah line, one of them was in Boulder County, 12 or 15 miles out of Denver. The remaining two cases were in the city of Denver. One of these is now convalescent and will soon be out of quarantine, and the other has been out of quarantine for some little time. The two cases occurred within about one month of each other. That is all that I am able to report as to the disease in my State. We are watching things very closely and are trying to keep track of all people, especially those having children with them, coming from the East.

The SECRETARY. Connecticut; Dr. John T. Black.

Dr. BLACK. Connecticut had three cases in June, apparently sporadic; in July, 165; and in August, 155, making 320 since the 1st of July. Of the first 200 cases in Connecticut, 34 were nonresidents, having come recently from New York.

The present problem of the disease in Connecticut is peculiar, owing to our proximity to New York and the cheap transportation facilities which are offered to the poorer classes by the Sound lines, trolley and automobiles also affording close connection. The spread of the disease to the State has been by these different routes. We have established in Connecticut about 20,000 children from New York at the present time. They are divided into different classes, the largest class being the Jewish population. They come in on the farms, anywhere from 10 to 80 to a farm. It has been from these sources that we have been getting most of the direct and indirect exposures—I mean direct cases from New York and the New York exposures. In the tobacco district we are finding the infection among the Italians, owing to the influx of labor for the tobacco harvest; in the Italian districts of Connecticut, in Stamford, Bridgeport, and New Haven, they have used registration and observation, and local communities in some instances have adopted rigid quarantine measures against New York, which will no doubt come out later.

The SECRETARY. Delaware; Dr. W. P. Orr.

Dr. A. E. FRANTZ. Mr. Chairman, Dr. Orr has very kindly shifted the responsibility of responding for our very large State. We have had in Delaware but two cases of poliomyelitis. Our population is only 215,000. These two cases have been of children, one 3 years and the other 5 years of age. They have both been residents of Delaware. We, however, claim that they were both imported cases; that is, the disease was brought into the State by the children themselves. The first patient visited New York July 4, returning from there on July 5. On July 11 the child was taken with vomiting, fever, etc., the usual symptoms, with slight paralysis of the left leg following in a day or so. This was a mild case and it is recovering, there being no paralysis remaining.

The other case was that of a boy 5 years of age, who visited Philadelphia August 5, where he traveled on the trolley cars as far as Willow Grove, returning the next day. On the 12th he was taken with vomiting, headache, fever, and symptoms of poliomyelitis, although he had been complaining for a few days before. He had complete paralysis of the right limb. Partial paralysis of the muscles of deglutition and respiration developed, and at 4 o'clock on Wednesday morning—the 14th—the boy died. This was an imported case.

We have no other cases in Delaware at the present time. We feel that the quarantine regulations in Delaware are quite rigid. When cases are brought to our notice we establish an absolutely rigid quarantine, which extends for a period of 21 days after disinfection or recovery. That quarantine, so far as children are concerned, is carried for that period of time after disinfection. The older members of the family—that is, the workers—are allowed to go after disinfection is completed; and that disinfection, I would say, is as complete as we know how to make it—by scrubbing, cleaning, and formaldehyde fumigation.

As to the State quarantine against our neighbors, Delaware established a quarantine on August 9 against New York, New Jersey, and Pennsylvania. This quarantine is absolute with children under 16 years of age who do not present at our borders a proper health certificate from their place of origin. The cases that come into our State from infected districts or those who have been suffering from poliomyelitis will be placed under rigid and strict observation, so as to prevent, if possible, any foci of infection developing in Delaware. There are rules, regulations, and instructions to our health officers and the cards that we have issued up to the present time, and if we develop poliomyelitis we will have outgoing cards issued for those departing from infected districts; those we have not issued yet, but they will be secured.

The SECRETARY. The District of Columbia; Dr. W. C. Woodward.

Dr. WOODWARD. Mr. Chairman, we have had from the beginning of the current calendar year 16 cases, of which 14 have occurred since the 1st of July. Of the 14 cases occurring since the 1st of July, 2 have been imported, 1 from the State of New York, and 1 from the State of New Jersey. Of the total number of patients 2 have died. In the year 1914 we had 8 cases. At the present time we have established no quarantine against anyone.

The SECRETARY. Illinois; Dr. C. St. Clair Drake.

Dr. DRAKE. Since the 1st day of July we have reported to the New York State Board of Health 230 cases. Each one of these cases has been visited by the district health officer and by the epidemiologist. Twenty-four of the cases have proved not to be poliomyelitis, leaving, since the 1st of July, 206 cases of confirmed poliomyelitis. There have been 18 deaths up to date, a rate of about 9 per cent.

At the present time we have 142 active cases in 76 localities, 50 of which are in Chicago. Of the cases reported in the last few weeks outside of the city of Chicago, 40 per cent are in strictly rural districts; that is, on farms, and apparently with no connection whatever between them, so far as we can ascertain, and the centers of population. Seventy-one per cent of our cases are those of children

under 5 years of age. Out of the 76 communities affected only 11 have more than 1 case.

So far as quarantine is concerned, I may say that we have had very rigid requirements for the last two years governing the control of poliomyelitis. These were amended in July because of the outbreak in New York, and made more rigid. Our period of quarantine is five weeks. We have not quarantined against New York or any other infected area. We do, however, as a matter of protection to the State, inspect the passengers on all incoming trains from the East. The Chicago health department furnishes a number of health officers to inspect all trains coming into Chicago. We require that the railroads shall report to us by wire the presence of children under 16 years of age and their exact destination. We advise the health officers as to the destination of these children and keep them under observation for a period of 21 days—not confinement, but observation. We have had but one case in Illinois that could be traced to New York, and that child left New York about July 1 and came across country by automobile, and afterwards developed the disease in Illinois 21 days after leaving New York. So far as our other requirements and quarantine are concerned, I presume that will be taken up by others.

The SECRETARY. Indiana; Dr. W. F. King.

Dr. KING. Mr. Chairman, Indiana had more poliomyelitis in 1911 and 1912 than it has at the present time. In the year 1911 and 1912 we had a rather extensive epidemic that swept over the State from northwest to southeast, and at that time the State board of health made a statement of 684 cases occurring in the State. The 684 cases probably did not represent more than 60 per cent of the actual number.

Poliomyelitis has been a quarantinable and reportable disease since 1911. Our regulations have been changed in the present epidemic. All cases are reported to the local health officer and to the State board of health. Quarantine is required for 28 days from the beginning. Local regulations are under the administration of local health officers and are outside of the rules of the State board of health.

Indiana has quarantined against no section and has no quarantine regulations, except those governing the control or attempt to control infantile paralysis within the borders of the State. I think four cases have been reported in that way.

The SECRETARY. Iowa; Dr. Henry Albert.

Dr. ALBERT. Since July 1 there have been 25 cases of poliomyelitis in Iowa. These cases have been scattered over various parts of the State, the largest number, eight cases, occurring in one locality in the northern part of the State. This is a place where we had a serious

epidemic in 1910. There was an investigation at that time. I may say that no quarantine has been established against any State or any locality.

Individual cases are quarantined, and quarantine is maintained for three weeks from the beginning of the disease. I may say that we feel that the bulletin which has been issued by the State board of health, written by Dr. Sumner, the secretary, has done a great deal to allay fear as to the disease. At the beginning considerable alarm was felt in various localities, but since the issuance of the bulletin, which has been widely copied by the newspapers, fear has been largely allayed. I may say that I have here a copy of this bulletin, which I should like to leave with the secretary. We feel that it has done a great deal in not only allaying the fears of the people, but also in preventing the spread of the disease. We are in hopes that we will not have a recurrence of the epidemic of 1910.

The SECRETARY. Kentucky; Dr. J. N. McCormack.

Dr. MCCORMACK. Kentucky does not impose rigid quarantine against any State; has never done it, even with yellow fever. We require the reporting of cases coming from infected areas and the keeping of them under observation until the period of incubation has passed.

On July 1 the regulations in regard to certain diseases, and this disease in particular, was made the subject of a bulletin which was widely distributed, and through the newspapers placed in the hands of almost every family in the State. Since then we have required the railroads, as we have always done with regard to yellow fever and other diseases, to report children of nonimmune age to the State board of health, and required the local boards to keep them under observation until the period of incubation has passed.

Up to yesterday we have had 18 cases of poliomyelitis reported this year. None were of children from infected areas, and a majority were from the rural districts. Our rules require that the cases be kept in quarantine for five weeks and the most rigid precautions taken, so far as the management of the patients themselves is concerned.

Our publication, as Dr. Albert said in regard to their publication in Iowa—and that may be emphasized by other gentlemen—has done much to allay public fear and excitement, and we feel in the main that we are prepared to deal with an epidemic should it occur, so far as our present knowledge is concerned.

There is one point that is coming up in Kentucky and has been made the subject of keenest consideration, which I hope may receive some consideration from this conference. As with some other diseases, scarlet fever and infections of that class, we have for years had

and now entertain grave doubt as to the extent to which so-called "sweatshops" in the great centers of population are the means of dissemination over the country. As is known, in the crowded tenement quarters in some of the cities, where there is not rigid inspection, it has often been found that contagious diseases exist in the rooms where clothing is being manufactured, and our fear has been that where there is not rigid supervision this avenue furnishes the greatest means for a wide diffusion of disease. I know that in some of the cities this subject has received consideration, and probably to an extent by the Public Health Service, but we have had considerable fear not only from poliomyelitis but of similar communicable diseases from these sources of contagion. I ran over from Canada yesterday. I have been out of the State for a few weeks, but I am in touch with the board every day by wire, and I am here as a student to gather information, which we all need very much, particularly as to this disease. I hope that if this fear of ours is groundless of danger from infected clothing it may be removed by the consideration which this conference may give this subject.

The SECRETARY. Louisiana; Dr. Oscar Dowling.

The CHAIRMAN. A telegram from Dr. Dowling states that he is four hours late. He will come direct to the conference as soon as he arrives.

The SECRETARY. Maine; Dr. A. G. Young.

Dr. YOUNG. We ordinarily have in Maine a larger number of sporadic cases of this disease than we have had this year. For instance, last year there were 19 or possibly 20 cases. This year, up to the end of July, we had only 1 case. That developed early in the year. Our first case since the end of July occurred at one of the seaside summer resorts, where there were about 100 guests. A child in the family came from Montreal. Possibly the infection was brought from New York, as there were two guests there from New York City. The child died on the third day of illness. The next day we had a case at the terminus of the railroad which goes up through the center of the State to Moosehead Lake, at a place called Kineo. The patient was a young man 27 years of age who had come from New York City to visit his parents. He was taken sick on the second day after his arrival, and died on the third day of his illness. There was complete paralysis of the lower limbs and almost complete paralysis of both upper limbs; one was fully paralyzed and the other not quite fully, death resulting from paralysis of the respiratory tract.

We have had no extension of the cases in either of those places. The second case I speak of was plainly brought from New York. These deaths occurred, as I have stated, on August 4 and 5. In

Portland there has been just one case. That patient is now convalescing. Two rural communities, Canton and Atkinson, each had a single case. Neither had been away from the farm homes. There was no communication and apparently no chance of contact with any infected case. Those were sporadic cases.

In the city of Rockland there have been several questionable cases; but we take care of the questionable cases just as we would those in which positive diagnoses have been made. The first case was not reported; diagnosis was not made. It was probably a case of poliomyelitis. There have been other cases since. The local board of health is doing efficient work, and I am hoping that we will have no further trouble; but because of the fact that the first case was overlooked, and for quite a number of days possibly the disease was present, some of the other summer resorts and the surrounding towns are quite panicky. Altogether we have had 14 cases this year, 13 since the beginning of August. That, I believe, is all I have to report.

I would say that we have every year a very large number of New York people who visit our summer resorts along the coast and in the interior, and I am quite surprised that we have not had a larger number of cases than we have had.

The SECRETARY. You have had a total of 14 cases for the State, then?

Dr. YOUNG. Fourteen cases altogether.

The SECRETARY. Maryland; Dr. John S. Fulton.

Dr. FULTON. The State of Maryland reports up to night before last, the 15th, that all Maryland has had 34 cases of poliomyelitis. Maryland has one and a third millions of population. There is only one large city, Baltimore. After Baltimore there is no city as large as 30,000 population, so that I simply report under those two heads, Baltimore, and Maryland exclusive of Baltimore. Baltimore has had up to night before last 13 cases of poliomyelitis. In the corresponding period in 1915 Baltimore had 25 cases. That part of Maryland which lies outside of Baltimore had, up to night before last, 21 cases, and in the coresponding period of the previous year 31 cases. For all Maryland we had, in 1915, 66 cases, and we have at this time 34 cases.

Poliomyelitis has been a reportable disease in Maryland for several years, and has been regularly named on our notification cards. We consider our notification system an excellent one. Maryland at this time has made no quarantine regulations against any State, nor has there been any internal quarantine up to the present time.

The SECRETARY. Massachusetts; Dr. A. J. McLaughlin.

Dr. McLAUGHLIN. Mr. Chairman and gentlemen, we had in Massachusetts in July 105 cases. It is going to be worse before it is better, and we will probably have 300 or 400 cases in August.

We think that we could account for most of our cases if there had never been an epidemic in New York, but certainly some part of our problem comes from New York infection. The disease is reportable in Massachusetts. The physicians of Massachusetts are reporting the cases, and in fact have overreported to some extent. Every patient is examined by one of the district health officers of the State, and some of the cases are thrown out as not being poliomyelitis.

There have been no quarantine restrictions in the State. The city of Boston and the summer resorts on Cape Cod and the south shore have very close connections with New York, but there has been very little poliomyelitis in that section. The disease has been most prevalent among very poor people, in towns like New Bedford and North Adams. It is not entirely confined to these, however, as is shown by a case reported just before I left. A young man who had just returned from Plattsburg within two days after his return came down with the disease. He was a young man of wealthy parents. It seems to me that it is a most difficult disease to control by quarantine restrictions, and as a health officer I hesitate to put on the restrictions without having some idea of the results we will obtain. As you know, in Massachusetts the State has no power except in an advisory capacity and we have advised the prompt reporting and isolation of cases. As for people from outside of the State who have not developed the disease we have recommended observation for a period of three weeks, but not detention in quarantine of any kind. However, some local communities have exercised their prerogative and have taken more drastic action in a few instances. One town, Great Barrington, I believe, will not allow an automobile to enter with a child in it; and I was told that they would not even allow an automobile to pass through the town to a town more leniently inclined. The State, however, has not taken action imposing quarantine or advising quarantine upon travelers from New York or any other State.

The SECRETARY. Michigan; Dr. John L. Burkart.

Dr. BURKART. Mr. Chairman and gentlemen, we have had since the 1st of January, 1916, 97 cases of infantile paralysis reported to the State board of health. We had 21 cases, scattered over 17 counties, up to August 10; since then we have had 76 more cases.

As a matter of record we show that in 1910 we had 104 cases; in 1911, 68 cases; in 1912, 78 cases; in 1913, 56 cases and 29 deaths; in 1914, 49 cases and 28 deaths; and in 1915, 94 cases and 34 deaths.

Michigan conducts her public health affairs on the township system. The local board of health has an absolute right to institute any quarantine measures that they see fit to impose. The State board

of health recommends what the quarantine regulations shall be. We have no authority other than in an advisory capacity, except in cases of an epidemic. We have authority to quarantine against New York or any other State if, in our judgment, such a procedure is warranted. Consequently we are making our great efforts with the township, city, and village boards of health in order to make them protect themselves and make the system self-working. We have for some time declared infantile paralysis a dangerous communicable disease; in fact, nearly a year ago I was instrumental in endeavoring to get our board to make it reportable. Of course, it is compulsorily reportable. We quarantine and isolate all persons who have been in an infected household, making provision for releasing the adults under certain conditions. The minimum period is four weeks. I will leave this map with the conference as a matter of record.

The State has not taken any severe measures relative to quarantine against outside communities. We are located very fortunately in Michigan, in that we have but two big ports of entry, Port Huron and Detroit. A circular was sent to the health officers of each of those ports early in July asking that very strict supervision be exercised over persons coming from New York or any other infected area. Michigan is a great summer resort State. We have a considerable influx of people from the West and the South, but very few from New York. We started early to make an inspection of these summer resorts. Every health officer was called into council, and instructions were given particularly against allowing persons from New York State to come in unexamined. We have not found it necessary to quarantine, as I said, against New York State.

The SECRETARY. Minnesota; Dr. H. M. Bracken.

Dr. BRACKEN. Mr. Chairman and gentlemen, Minnesota to her knowledge has had infantile paralysis since 1908. In 1908 we had an estimated number of 150 cases, with 9 deaths; in 1909 we had 900 cases, with 234 deaths; in 1910 we had 631 cases, with 201 deaths; in 1911 we had 117 cases, with 59 deaths; in 1912 we had 43 cases; in 1913, 90 cases; in 1914, 32 cases; in 1915 we had 127 cases and 26 deaths.

This year, prior to July 19, we had 47 cases; 10 of these died. Up to August 15 there were 318 cases, with 29 deaths, 271 of these occurring after July 19.

These cases are from 104 sanitary districts, i. e., townships, villages, and cities. Of these 318 cases, 35 were in St. Paul, 72 in Minneapolis, and about 30 in Stearns County.

In Minnesota the disease has been reportable since 1909, I believe. Ordinarily it is reported by the physicians to the local health officers. This year we made a ruling that it should be reported immediately to the State board of health by telegraph or telephone, so that we

could get in touch with the cases more quickly. The cases are isolated; there is not a rigid quarantine. It is our intention to follow up each case reported, and some of the reported cases have been excluded. The physicians are very good, indeed, about reprting suspicious cases, even directly, so that I think we are getting a large percentage of them. The State made an extra allowance to the State board of health for help in this work, so that we have been able to employ whatever assistance was necessary, and the university is cooperating with the board, and has just now put a man in the field with us for two or three months.

Of imported cases, so far as I remember, we have had but two. One was from Montana and the other was from Saskatchewan; so that New York is not the only place from which cases have been derived. Our cases are scattered, and some are in remote districts, and it is very hard, indeed, to determine how they originate.

We have not quarantined against any other State or against any community. The board did not consider that necessary. We think that we are wide-awake, and are helping the local boards of health.

The SECRETARY. Missouri; Dr. J. A. B. Adcock.

Dr. ADCOCK. Mr. Chairman, we have in Missouri about 3,000,000 of people. We have had reported from June 1 to August 15, 11 cases of poliomyelitis and 4 deaths. We have had a few sporadic cases of poliomyelitis each year in Missouri since we began collecting such statistics, in 1910.

We in Missouri have not become alarmed yet, and the board of health has not instituted quarantine against any State. However, we have issued instructions to the local health officers throughout the State to isolate every case of poliomyelitis.

This disease with us moves in a mysterious way. We have had 5 cases in the city of St. Louis, with a population of 750,000 people, and 1 death; 6 cases have been reported from throughout the State, 4 of them on farms in the country and 2 in little towns or villages. No secondary cases have developed. It seems as if the disease drops down sporadically here and there and all around. We have ordered and have maintained strict isolation of the patients.

Really, I am here to learn something about the disease and means for its prevention, so that when our people get disturbed their fear may be allayed. I feel that we need not be alarmed in Missouri at the present stage of the disease, and in fact I believe we have had each year for the past four or five years nearly as many cases as we have had this year.

The SECRETARY. Montana; Dr. F. A. Cooney.

Dr. COONEY. Since the latter part of June we have had in Montana 15 cases reported; 9 of them are from one point and 4 from another,

and there is 1 each from two other sources, all tributary to the starting point.

The SECRETARY. How many cases altogether, Doctor?

Dr. COONEY. Fifteen.

The SECRETARY. How many deaths?

Dr. COONEY. No deaths.

The SECRETARY. Nebraska; Dr. E. A. Carr.

Dr. CARR. Mr. Chairman and gentlemen of the conference, Nebraska has had only 10 cases of poliomyelitis since the first of the present year, all sporadic, with 2 deaths. Poliomyelitis was declared a communicable disease in 1909, and from that time it has been quarantinable and reportable. Our quarantine on poliomyelitis is 30 days as a minimum. In 1910 the disease was epidemic.

Nebraska has a State orthopedic hospital, under the direction of Dr. John P. Lord, which is giving attention especially to these cases, thus benefitting the rich and the poor alike.

The SECRETARY. New Hampshire; Dr. I. A. Watson.

Dr. WATSON. Mr. Chairman, New Hampshire has a normal record, as far as this disease is concerned. There have been during the course of the year 7 cases reported and 2 deaths. They occurred in five different municipalities representing four counties. Not one of these cases was traceable to its origin, and there could have been no connection between them and the cases in New York and Brooklyn. They were evidently sporadic cases occurring among people who had not been in the city.

We have established no quarantine against any other State. In fact, we have left our doors wide open, and to-day in New Hampshire I am speaking within limits when I say there are thousands of people accompanied by children from New York, New Jersey, and Philadelphia. Their automobiles are to be seen in all of our boulevards. Aside from that, we have many summer camps established by parties from outside of the State, located on the borders of our lakes and in our mountain region, and still not a case of this disease has appeared among any of those children.

The State board of health of New Hampshire has absolute power to establish a quarantine; it has absolute power to approve, disapprove, or dismiss a local quarantine in case a local quarantine has been established against another State or municipality; but no case has arisen that has required any action on the part of the local authorities along those lines.

I may say that this disease has been reportable for several years in the State of New Hampshire, and in the present year we have a smaller number of cases than we have had on an average during the last seven or eight years. That is practically the condition that exists to-day in New Hampshire.

The SECRETARY. New Jersey; Dr. R. D. Fitz-Randolph.

Dr. FITZ-RANDOLPH. Since July 1, when the disease appeared in epidemic form, and up to yesterday afternoon, we have had 1,740 cases reported to the State department of health of New Jersey. Allowing for a day or two for reports to reach us, it is very probable that there are at the present time in the State about 2,000 cases in 175 out of the 496 districts. All the counties are represented except Cape May County in the extreme southern portion of the State. The disease has appeared in epidemic form in those sections adjacent to New York City and is spreading over the State at the present time. The State department of health requires that children under 16 years of age coming into the State must be provided with certificates from competent health authorities. This also applies to children traveling from one municipality to another. These regulations were made, first, for the purpose of apprising the local health officials when children came into municipalities; secondly, to discourage as far as possible the unnecessary traveling of children; and, thirdly, to attempt to bring into some sort of harmony regulations which were being made by local health authorities throughout the State. People in the northern part of the State adjacent to New York were considerably alarmed, and this resulted in the local authorities in some counties establishing quarantine regulations which brought about very great impediment to travel and considerable hardship. It was largely for the purpose of attempting to make uniform those regulations that the State department adopted the present system.

The SECRETARY. New York; Dr. George Draper.

Dr. DRAPER. Mr. Chairman, the commissioner of the State of New York sends his regrets to this meeting for his inability to attend. He only ordered me down here last night, so that he was unable to supply me with the figures for the State, but Dr. Emerson, of the board of health, furnished me with the figures for the New York City epidemic up to the first of this week, and they probably would dominate the total figures of the State, so that I should like to ask the chairman to call on Commissioner Emerson to give the figures for New York City. May I, however, ask one word? Are these figures that are being given now based purely on cases of paralysis or cases which have been diagnosed by other means but are not paralyzed?

The CHAIRMAN. Gentlemen, we have here by invitation Dr. Haven Emerson, of New York City, and I suppose you would be glad to hear from him, although he is not a State official. Dr. Haven Emerson, we will be glad to hear from you. [Applause.]

Dr. EMERSON. Mr. Chairman, I suppose I may be considered the chief conspirator in the epidemic. Up to yesterday morning there

have been 6,653 cases and 1,497 deaths in New York City. Since the beginning of the epidemic we have had a large number of cases reported which were found not to be poliomyelitis, the proportion being about 20 per cent of all reported cases. I mention this to indicate the degree to which the medical profession is reporting cases which are doubtful and which need confirmation. Every case which is reported as a true case is on the basis of the visit of a diagnostician, plus a laboratory report on the spinal fluid unless paralysis is present.

The epidemic began the 1st of June. In May there were reported to us 5 cases, which is much less than the usual monthly report for the last few years. In 1912 we had reports of about 40 cases a month throughout the year. On referring back to the month of May, those cases which have subsequently been found on a house-to-house survey and through reports of physicians and hospitals, we have learned that there were at least five times as many true cases in May as had been reported up to the 1st of July. By the 7th of June the division of epidemiology had notified me that there were a number of cases, closely confined to the South Brooklyn water front, limited to the children of Italians living in that vicinity. The upper chart on the wall here represents the onset in the city from that district as a whole, and the chart below represents the onset from the five boroughs, respectively. In the right-hand chart there is shown the weekly incidence of the disease in the various boroughs of the city as a whole.

On the 7th of June I had a report from the epidemiologist of the department that there was this grouping of the cases in certain parts of the city and among a certain race. On the 15th of June mothers began to bring in children to our baby stations—so-called milk stations—with the story that for several days the baby had not been able to lift an arm or a leg. It then developed for the first time that there were many unreported cases, even in places where we were hunting for them. On the 15th of June orders were issued that the disease be given special attention, and an increased force of diagnosticians and nurses was devoted to that particular field. On the 3d of July a special act of the board of estimate gave us authority to engage such labor and help as was necessary. From that time until well on in July the epidemic was pretty well confined to Brooklyn, although of the 15 cases just now discharged after eight weeks in quarantine 4 were from the Borough of Richmond, 4 from Manhattan, and 7 from Brooklyn, so that there was an increase in other boroughs almost immediately after this occurrence in Brooklyn. The race group represented by those cases was largely the Italian laboring class.

As to the disease in the State, I have no exact figures, but I feel quite confident that the cases are well over 1,000 and that the death

rate up to the present time has been about 9 or 10 per cent in the State, whereas in the city it is 22 and a fraction per cent.

If I am not taking too much time, I shall describe in detail the procedure now in force in the city and the instructions issued to the workers in the department [reading]:

I. GENERAL INFORMATION.

1. *Incubation period.*—The incubation period of the disease and the quarantine period of children under 16 years of age who have been, but no longer are, exposed to infection has been set at 14 days.

2. *Quarantine.*—In all families where a case of poliomyelitis has occurred all the children under 16 years (except those who have had the disease) are quarantined in the home until two weeks after the termination of the case by death, removal, or recovery. The patient, whether at home or in hospital, is quarantined for eight weeks from the date of onset of the disease. No case in hospital can return home until quarantine is ended.

We arbitrarily set the period of six to eight weeks at the beginning of the epidemic for the sake of bringing a certain amount of social pressure to bear upon people who would otherwise try to keep their cases at home. We tried to hospitalize the patients as much as possible, although we had no new evidence that the disease was infectious, and we are maintaining eight weeks as the quarantine period in order to persuade people to allow us to take their cases to the hospital, because the burden of expense would be so heavy if they kept them at home.

3. *Placards.*—All premises where a case of poliomyelitis occurs are placarded, except hotels and boarding houses, where patient is at once removed to hospital, room renovated, and no quarantined children remain on premises. In private houses one placard is placed on the street wall of the house and one on the door entering room the patient occupies. In apartment and tenement houses three placards are posted—one on the street wall, one on the wall of the entrance hall, and one on the door of the apartment. All placards are dated and initialed.

4. *Removal to hospital.*—No case is left at home unless the following conditions are complied with:

(*a*) There must be a physician in attendance daily and regularly.

That applies where other than medical practitioners report a case and state that they are in charge thereof. We do not consider that as sufficient protection to the community, and we require a physician in attendance.

(*b*) The patient must have a special attendant, who must obey quarantine regulations, and must not do any housework, marketing, or perform any household duties for other members of the family.

(*c*) The patient and the attendant must have a room or rooms separate from others in the family.

(*d*) All the windows of this room must be screened, and all flies in the room killed.

(*e*) The family must have a separate toilet for its exclusive use.

That was helpful in eliminating many cases from tenements which otherwise we would have been unable to remove. We did not wish the common toilet to be available, because of the recognized infectious character of the bowel discharges.

(*f*) Quarantine regulations must be strictly observed by the patient and the other children of the family, if any. When the disease occurs in the premises of families of food handlers, the employment of such person or persons at this occupation is forbidden, unless they occupy entirely separate apartments for a period of two weeks after the removal, recovery, or death of patient.

(*g*) *Disinfection and renovation.*—The personal and bed linen of the patient must be properly disinfected and, after removal, recovery, or death of the patient, complete renovation of the rooms occupied by the patient is required.

By "renovation" we mean scrubbing the woodwork, painting and papering, and calcimining where necessary; that is, the rooms are not to be occupied again until after the same precautions have been taken as in case of tuberculosis or other infectious disease.

II. DUTIES OF INSPECTORS.

Cases are reported by physicians, nurses, social workers, and other citizens, and all are visited at once by inspectors, even those reported by physicians with request that they be admitted to hospital. Attending physicians to department hospitals may admit cases direct.

The janitor or his representative must be seen in every instance and notified that he or she will be held personally responsible by the department for keeping quarantined children in the family premises and seeing that placards are not removed or defaced.

If the inspector makes or confirms the diagnosis of poliomyelitis the borough office of the department is notified, and by it the ambulance is summoned if removal is indicated. In every case the inspector leaves the hospital admission slip, properly and fully filled out.

All cases of questionable diagnosis are seen at once on consultation with the borough or chief diagnostician, and, whenever it is required, spinal puncture is made and laboratory report submitted by the staff of the research laboratory. Cases with positive laboratory findings are considered as poliomyelitis regardless of clinical signs. A full history is recorded on a special card (Form 316–V) for each assignment covered by inspectors.

III. DUTIES OF NURSES.

Nurses visit every case reported to instruct the family regarding quarantine, and every other family in the house.

(*a*) That there is a case of this disease in the house.

(*b*) That the other children of the family in which the disease has occurred will be quarantined, and that, should they fail to observe quarantine, that fact should be immediately reported to the department of health, when steps will be taken to enforce quarantine by a summons to court.

(*c*) Regarding home cleanliness, personal hygiene, the danger of infection by flies, and other general measures which should be taken to prevent infection.

(*d*) To report at once to the department any cases of suspicious illness of children or any cases of poliomyelitis, especially if there is no physician in attendance.

A current history (Form 304–V) is kept by the nurse for every case, giving dates of visits, action taken, and date and mode of termination.

Nurses must see the janitor or his representative on the first visit and repeat the instructions given by the inspector. Patients remaining at home and families with quarantined children are visited at least twice weekly by the nurse for the maintenance of quarantine, and oftener if necessary. After removal, recovery, or death of the patient, nurses issue renovation notices, following these up by visits until complied with.

IV. DUTIES OF SANITARY POLICE.

These officers visit frequently—daily if necessary—premises in which patients have been allowed to remain, to enforce quarantine and to affix or replace placards. They serve summonses when quarantine regulations are broken and appear in court.

V. AMBULANCE SURGEONS.

All cases ordered removed to hospital must be removed without question, with the following exceptions, in each of which the ambulance surgeon must obtain authorization to leave the case at home from the resident physician of his hospital by the nearest telephone:

(*a*) When removal would endanger life of child (bulbar symptoms).

Bulbar cases may be so aggravated by the least movement, such as that incident to the removal to the hospital, that it might be thought best not to remove the patient.

Mr. Chairman, we have refrained from removing cases that were in a serious condition physically, awaiting the outcome of bulbar symptoms. If physicians can show that the requirements will be complied with, they can have the patients stay at home pending 24 hours' observation.

(*b*) When family physician can show that requirements will be met.

(*c*) Doubtful and mixed infection cases must be removed by themselves in a separate ambulance.

In every case ambulance surgeon must leave a card with parents, giving name and address of hospital to which patient is taken. If inspector has not left admission slip, surgeon must make out same.

VI. VISITORS TO HOSPITALS.

Each case may be visited twice during its stay in the hospital by a parent or guardian. If child is critically ill, the guardian or parent will be notified and will be permitted to visit daily while child is dangerously ill.

Information relative to condition is given out at the information desk in each hospital or by telephone in response to telephone inquiry from the parent or guardian.

VII. HEALTH CERTIFICATES.

All field employees must have had and be familiar with the circular of information regarding health certificates.

VIII. ALLIED, SOCIAL, NURSING, AND LAY WORKERS.

Nurses supplied by the Charity Organization Society, the Association for Improving the Condition of the Poor, the United Hebrew Charities, Henry Street Settlement, and Brooklyn Bureau of Charities, and lay visitors from various social-service organizations under the direction of the department of health make an intensive house to house, family to family survey in infected districts to find unreported cases; to verbally instruct regarding the disease and its prevention by personal and domestic hygiene, and to report illness, especially of children, and insanitary conditions.

The Metropolitan, Prudential, and John Hancock insurance companies distribute literature by their visitors who also report illness and insanitary conditions.

IX. ROCKEFELLER FOUNDATION.

Physicians and nurses supplied by the Rockefeller Foundation, under the direction of the department of health, follow up the ramifications of all reported cases of poliomyelitis, and also do house-to-house inspection, and report suspected cases.

As regards the cases in the State, the records show that there were one or two foci of infection in the State outside of New York before the city epidemic began. The two general areas principally infected by people leaving the city are the Catskill region, which was very rapidly flooded by the Jewish people, who have made this their headquarters in summer for many years, and certain parts of Long Island adjacent to New York City.

Furthermore, the boroughs most recently affected have shown that the cases developed from the boroughs earlier infected. That is the case now in Queens and Bronx Boroughs, where many cases are directly traceable to the moving of families from the older settled parts of Brooklyn. These families are now living in the least congested boroughs, the Bronx and Queens. There have been no provisions excluding people from other cities and States, and we have received patients suffering with poliomyelitis from many adjacent States, with the consent of the local health officers because the facilities for treating persons with this disease were available in the city and were not available in other places.

The issuing of certificates was undertaken for the convenience of the local health officers outside of the great cities, and there have been up to date 86,000 of these certificates granted and 348 refused. The causes of refusal to issue certificates were that people had come from premises where infection existed at the time or where people were, frankly, suffering from poliomyelitis or other temporary illness which was sufficient cause to hold them under observation. Mothers came with their children in their arms suffering with the disease, so that the certificates may have saved some few people from leaving New York with the infection. It is obvious that certificates can

serve merely as a means of identification for the health officers elsewhere and in no sense as a complete means of protection against the disease, inasmuch as the symptoms in the incubation period are absolutely nil. Therefore within two weeks of the time when an apparently absolutely healthy person may have received a certificate the disease may develop, at which time that person may have gotten as far as San Francisco. The certificates were not issued except for the convenience of travelers and as a means of identifying the origin or place of departure of visitors destined to places outside of the presumably infected city.

The campaign of publicity undertaken by the city and supplemented throughout the State by the State department of health has had important results. Parents have been warned that during the epidemic they can not afford to allow any sickness to pass without the observation of a physician, and physicians have been advised of the early symptoms of the disease, so that they may be suspicious of cases which are similar to other mild attacks of disease. They were also informed that the presence of the disease should be verified by spinal puncture or other diagnostic procedure. These were the only resources we had, with the exception of isolation or quarantining of the cases. We have isolated in New York about 66 per cent of the true cases discovered. We have in the hospitals now 2,384 patients with this disease, and of those 2,300 are in the hospitals of the health department and 300 in other hospitals.

There are two or three striking facts that have developed. One is in answer to a question recently asked. There was a strike of the garment workers in New York, lasting three months, which extended over the entire period of this epidemic and up to a week ago, so that New York has been producing in the last summer less sweatshop material than at any other time, and the people have not been working in places of that character.

We have 30,000 children in charitable institutions in New York, supported partly at the expense of the city and partly at the expense of the charitable institution. All of them are under the control of the department of health so far as quarantine regulations are concerned. We maintain a two weeks' quarantine of all children committed to those institutions. There has not been a single case among those 30,000 children in the city of New York. They have had the same water and food supply, have been accessible to the same insects, and have been subject to the same temperature and the same conditions in general as other children, but they have not been in contact with infected children. Furthermore, from the beginning of the epidemic we forbade the visiting by parents at these institutions. These institutions have been isolated in the city with 30,000 children,

as susceptible to the disease as any others, and no cases have developed among them.

Take another instance. Barren Island is the place where all the city garbage is carried by scows, handled and treated, and all dead animals are conveyed. No case of poliomyelitis has occurred among the residents of Barren Island, remarkable as it may seem. I say that because it is a place where one might expect the maximum of fly-carriage infection and the maximum contact with serious garbage conditions. These people do not go off the island much, and nobody visits them unless they have to, so that the place has been isolated, so to speak.

The Borough of Richmond has had, up to the present time, a case incidence of 2.5 per thousand, and the Borough of Queens is already as high as that. The Borough of Brooklyn has about 1.5, I think. At least it is under 2. Yet Brooklyn has had, up to the present time, 3,800 cases and the Borough of Richmond 256 cases. The borough with the widest separation of its people and the smallest number of persons per acre shows the highest case incidence of the disease; and Queens, the next most open borough, gives the next highest case incidence. The most congested boroughs up to the present time show the smallest case incidence of the disease.

The age average is 1 per cent over 16, 15 per cent under 1, 85 per cent under 5, and 95 per cent under 10 years of age.

Our last previous serious epidemic was in 1906 and 1907, and a large majority of all the children affected at this time have been born since the previous epidemic.

I am sorry I can not be more specific about the State report. Dr. Williams, who is the deputy commissioner, is detained by another appointment in New York which could not be given up, and he has asked me to make a general statement for the State. The State has not quarantined as a State against other communities, but many communities in the State which have entire independence in establishing quarantine have adopted rigid quarantine, such as those described by Dr. Randolph in New Jersey. [Applause.]

The CHAIRMAN. I am sure the delegates have been very glad to hear from Dr. Emerson, and on behalf of the conference I wish to thank him for coming here and making this very interesting talk.

Dr. BRACKEN. Is there any relationship between the stables in Brooklyn and the occurrence of the disease? Have you made any examination as to that?

Dr. EMERSON. For two years the stables in New York have been the subject of consideration, and we have been making increasing efforts to control the collection and distribution of manure, and there is no difference, so far as we have been able to determine, between

the conditions in Brooklyn and those elsewhere. There are a good many stables among the poorer tenement sections in Brooklyn, but no more than are present in many other regions. The small vendors and Italian truck distributors, many of them, have their stables in their section. Mr. C. T. Brues assisted Dr. Rosenau in his study of the insects in Massachusetts in their recent epidemic, and his work may develop the possible insect carriers, with the entomologists who are working under the direction of the Public Health Service. No promising facts or even coincidences between insects and the development of the disease in the city have so far been discovered.

Dr. WOLFF. I would like to ask Dr. Emerson, and probably there are other gentlemen present who may have had experience with the disease from which they, too, may be able to answer, if they have investigated and determined positively concerning the relationship between poliomyelitis and the presence of domestic animals, cats, dogs, chickens, and the like? It seems to me that that is an extremely important question to clear up, as to what relationship might exist in the case of these animals.

Dr. EMERSON. For some years past, under the sanitary code of the city, the keeping of chickens or other animals on premises occupied by tenements has been forbidden. There are no chickens kept on the premises of these poor people, in no instance on the premises occupied by tenement houses.

As regards dead animals, there have been about eight times as many dead animals removed from Brooklyn in the last six weeks as in the corresponding six weeks of a year ago. That seems to indicate either a form of epidemic disease in animals, or a sudden change in the social habits of the people. An analysis was immediately applied to this question by the veterinarians of the department and officers acting under the Public Health Service, but up to the present time the death of these animals has not been found to be attributable in any way to disease of the central nervous system, or any increase of other disease. Many people have been killing their own cats or stray cats which they have previously harbored. In many cases, instead of throwing them in the garbage can, they have notified the police at once. The Society for the Prevention of Cruelty to Animals has cooperated, and numerous animals have been submitted to observation, but up to the present time no infection has been found among them, or any disease which is transmissible, I believe, from one animal to another. I can not speak with authority in this matter, but I believe that is the conclusion.

The SECRETARY. North Carolina; Dr. W. S. Rankin.

Dr. RANKIN. I have had reports of about 20 cases over a period of the last two months. There is nothing unusual in the character

of those cases, with one exception. In one county there are 6 cases, and in one town there are 5 cases, and the 5 patients came down within three weeks of each other. That is the only evidence of any common origin existing between cases that I have any record of. There was one case that developed in the extreme eastern section of the State at Southport, which the health officer reports to me as having come from New York five weeks previously. That is all the information I have, and that is in a telegram. There was a newspaper report yesterday of the death of a man at Greensboro who had recently been in New York.

Last year we had 17 deaths reported, which, with a fatality of 10 per cent, would give us about 170 cases. With the single exception of the one town mentioned there is no evidence in North Carolina of an unusual occurrence of the disease.

The SECRETARY. Ohio; Dr. F. G. Boudreau.

Dr. BOUDREAU. Anterior poliomyelitis was made reportable in 1910. Our reports were quite inadequate until recently, so that I will have to give you simply totals. In 1910 there were 74; in 1911, 142; in 1912, 159 cases. This year there were 166 cases from January to August 15; 9 was the largest number of cases in any county. The largest number of cases in any month was in July, when 93 were reported. So far there have been 34 cases reported in August up to August 15. About 115 cases are now quarantined in the cities; these cases have been reported from 53 widely scattered health districts.

Lucas County has the highest number of cases, 50, of which 47 are in Toledo. In the month of July 33 cases occurred in the city of Toledo. Of the 53 health officials, 43 report single cases only, so that only 10 health officials report more than one case.

We do not enforce a quarantine for acute poliomyelitis in Ohio, but we recommend that all health officers establish such quarantine. We discourage the congregating of children. We have no rules governing the entrance of children into our State, but some of our children who have left the State recently have been interrupted in their travels, although they did not go from infected districts.

We have had excellent cooperation from the Public Health Service and from the health commissioner of the city of New York. We have received a number of children from other districts, particularly from New York, and we have kept those children under observation.

The SECRETARY. Oregon; Dr. D. N. Roberg.

Dr. ROBERG. In Oregon the statistics show that in 1910 there were 143 cases, with 54 deaths; in 1911, 55 cases, with 16 deaths; in 1912, 5 cases; in 1913, 3 cases; in 1914, no cases.

In the last 13 months there have been 3 sporadic cases. In Oregon we have no tenements or slums, as in the larger cities, and the tendency is to believe that the sporadic cases do not become epidemic.

On July 15, when we learned that San Francisco had had an imported case, we immediately tried to put into effect an inspection of all trains and railway stations. The expense of this was considerable and we found we would have to form a cooperative plan with the neighboring coast States, so that on July 15 a conference was called, at which were represented California, Oregon, Nevada, Idaho, Washington, and in addition the district of British Columbia. Representatives of the various railroads and of the Public Health Service were also present. These five States and British Columbia adopted a uniform set of regulations, a copy of which I will leave with the secretary. This system is cooperative. It does not quarantine against any particular place, neither does it tie up railroad traffic. It is working splendidly in Washington and Oregon, to my knowledge. In California, which has been using the inspection system, according to a letter which I received on August 10, they have adopted this notification system, and will probably entirely dispense with the inspection system. The notification system consists of the passenger from an infected point traveling west, filling out a card giving the starting point of his journey, date of departure, and destination, naming the city and State. This card, showing the address of the passenger, is left with the ticket agent from whom the ticket is purchased, who immediately forwards it to the health officer at the place of destination, the passenger going immediately to his home where he can be kept under observation. In case of illness of a passenger the conductor is instructed to telegraph ahead, either to the passenger's destination or to the nearest point on his line where he knows there is a health officer.

We wish to thank the Public Health Service for cooperating with regard to one of our regulations which provides for a card being sent to us from the infected district. We use the cards from them to check up the cards from the conductors.

The SECRETARY. Pennsylvania; Dr. S. G. Dixon.

Dr. DIXON. Mr. Chairman and health officers of the United States, I have very little to say. To cover a multitude of details I will refer you to a report made by the Commonwealth of Pennsylvania on the epidemics of 1907 and 1910. In those years a most intensive study was made and an investigation of the houses and all conditions throughout the Commonwealth, as well as intensive laboratory studies. That intensive study was reported in full, and those reports, if you have not secured them already, are available and obtainable by you upon request. There has been very little additional informa-

tion discovered by our department in this epidemic beyond that found in 1910.

This present epidemic began about the 1st of July, and up to yesterday we had 336 cases and about 50 deaths. The death reports do not come in, however, as soon as the case reports, because case reports are wired to the State department. Every case in the State is checked off by a State officer, or in cities of the first and second class by the officers of those cities, and no case is reported unless paralysis has taken place. Other cases, however, are studied and kept under observation.

Pennsylvania was going on in the even tenor of its way in regard to the control of this disease, as it had in other years, until we found that it was gradually creeping up on us, and we discovered that children were coming over from New Jersey and New York from infected centers. Then, upon investigation, we found a number of children came over who were infected, apparently so because of the time in which they came down with the disease. We even discovered children coming over in the acute stages of the disease. On account of our ignorance in regard to the nature of the disease, its transmission, etc., we concluded that it was better to keep infected cases out of the State, or, in other words, merely to ask the other States to do what we were doing ourselves and to inform us of conditions.

In Pennsylvania quarantine is absolute. The room or rooms in which the children are kept have all insect life exterminated and are screened. They are visited by nurses every day, or, if not by a nurse, by a competent attendant. The wage earner, however, when the disease is first detected, can be disinfected and can leave his home and remain away until after the quarantine period. This is to save the great expense that would otherwise be placed upon the poor boards throughout the Commonwealth. We have instructed individuals and the various municipalities to clean up thoroughly and to try to exterminate insect life, even insects found on animals. That was referred to a while ago. Dogs and cats are supposed to be disinfected or done away with.

I want to say that there is one thing that seems to be most important upon which we are working. There is a feeling that fly-breeding places are infected more than where such breeding places are not found, so much so that we are paying a great deal of attention to exterminating flies. We speak of the thickly populated places, against more sparsely populated ones. Philadelphia has about two-thirds of the cases. Outside of Philadelphia there are six and a half millions of people, scattered over 45,000 square miles. We have cases developing in the most remote and mountainous districts, where we can only detect communication with the outside through the United States mail and the foodstuffs and clothing received.

There is absolutely no contact with other people from infected houses. Very markedly is the fact set out throughout the entire State that there are very few secondary cases in families having two or more children. That is a fact that stands out everywhere, not only here but in New York City as well, which certainly indicates that man has a great resistance to this infection, because there is hardly a county in Pennsylvania, and there are 67 counties in the State, without one or more cases of this disease. The poison must be very widespread, and yet there are few secondary cases. We had 398 patients who slept in the same beds and ate of the same foodstuffs, and lived in the same environment so far as we could determine, and yet we had only 23 secondary cases.

Dr. Emerson has said something which I think ought to have great weight with us all, and it is very comforting for me, because I have been responsible for the quarantine in Pennsylvania. He says what we have found to hold true in the Commonwealth of Pennsylvania, that in these great institutions where they have so many children, which have been practically quarantined, there has not a single case of this disease developed.

Gentlemen, I might go on and give you all the details of our instructions and so on, but they are all printed, and if anyone desires them a postal card to Harrisburg will bring them. It seems to me that the great object of this conference is to bring about uniformity in handling this disease.

The CHAIRMAN. I want to thank Dr. Dixon for his statement, and I am sure that the conference is very glad he has been able to come here at this time.

The SECRETARY. Rhode Island; Dr. G. T. Swarts.

Dr. SWARTS. Mr. Chairman and gentlemen, of course, Rhode Island being a small State, this conference would not expect to get very much from it, but we are intensely interested in this question. The disease, poliomyelitis, has been reportable by State legislation since 1911. In 1910, during the general outbreak throughout the country, we had 248 cases and 46 deaths, and last year we had only 27 cases; so that we have the disease with us at all times, more or less. We have had in the State, since the outbreak in the middle of June, 53 cases with 9 deaths.

Our system of quarantine of those from outside the State is perhaps different from some States, and yet it is like many others which have been reported here. Rhode Island professes to be a hospitable community. There was a reverend gentleman named Roger Williams, who was ostracized in Massachusetts and came down to Rhode Island with the intention of making his home there, who was met by the Indians with words signifying "What cheer." Our system of quarantine is to receive anybody who comes, if they are able to come.

If they have poliomyelitis, they are not able to come. We do not expect inspectors at the railroad trains to be able to discover poliomyelitis upon the station platform. If people come to our State with the disease, we do not send them back. We have a proper reception for them, whether they come with or without the disease, and we give them all the quarantine, observation, and attention that the health officers can supply. [Applause.]

By our system at the present time, by the order of the board of health—and it is at my desire personally—we have trained inspectors on all trains. This requires 10 inspectors, there being two or three lines of communication by rail and several lines of boats coming from the infected places in New York. We are taking not only the names of those who come from New York, but also of those from Massachusetts and New Jersey. Our system is to ask kindly, if children under 16 years of age are in the company, "Where did you come from? What is your name and address, and where are you going?" so that we can take care of you after you get there. The only restriction we place upon persons coming into the State is this, that after they reach their destination they keep their children separate from the Rhode Island children, so that they can not get measles from the Rhode Island children. [Laughter.] The thing has worked out very nicely, so that from the time when inspection was instituted, June 18, up to a few days ago there had been received 415 families, representing 680 children.

Immediately upon receiving reports from the inspectors we refer at once to the lists which New York City sends out from there, showing all the cases in the last 24 or 48 hours. Our clerks go through every one of those lists. In that way they determine whether persons have come from an infected house in those districts. In two cases we have found that persons came from houses of this character, but no cases of illness developed. We have had children who were taken sick within two or three days after arrival. We could not tell whether they were sick before they started, and there was no reason to consider that there was any negligence on the part of anyone along the line. When people come into the State and we are notified, the local health officer goes to the house where they locate and places a limited quarantine of two weeks. Our term of quarantine for actual cases is four weeks. We do not detain adults. We request the attending nurse or the mother of the patient to keep herself as clean as she can and not to go among other people. We have not restricted the attendance of children at playgrounds. We have thought that the restriction of children from the open air would be more deleterious than the chance of a case of poliomyelitis.

The SECRETARY. South Carolina: Dr. J. A. Hayne.

Dr. HAYNE. Mr. Chairman, as this disease is one that we do not thoroughly know the cause of, we determined that we would institute quarantine, it still being a reportable disease and regarded as contagious. It was placed upon the list in 1908 in South Carolina as one of the reportable and quarantinable diseases, a disease which would be put in what we would call modified quarantine; that is, we thought the patient and the attendant or nurse should be isolated, the parents and other members of the family being allowed to attend to their vocations, provided they did not see the patients or come in contact with them.

About the 3d of July we received a telegram from the Surgeon General of the Public Health Service asking if there were any cases of poliomyelitis in South Carolina. We reported that there had been none since the 1st of January. On the 3d of July we issued an order to the health officers and local boards of health to report all cases of infantile paralysis by telegraph. Of course the newspapers have published a great deal concerning the epidemic in New York, the public were frightened, and the doctors were compelled to make reports of the disease whether they wanted to or not. As a consequence we had 18 cases of poliomyelitis reported in July. These were investigated by competent authorities and verified, the diagnosis being made by the paralysis.

We did not feel at all alarmed in July, except that the cases toward the latter part of the month were a little more numerous than in the early part. In the first two weeks of the month we had 5 cases, and in the last two weeks we had 13. When I left home it was the 15th of August, and up to that time we had had 37 cases reported during the month, making a total of 55 for the State. These cases did not occur in the large cities. We have but one city of any size, Charleston, and we have had only 1 case there. Columbia has 1 case. Rockhill, which has about 8,000 or 10,000 people, has 6 cases. The only interesting feature that I see in the report is in regard to a place called Swansea, a borough that trains hardly blow at as they pass, where they have had 16 cases, 2 on the 1st of August. On going over there, I found that two children had come to the town from New York; and there being no local health authorities, I presume the notification card went astray. It never reached anybody in the locality, and no precautions were exercised. In Columbia the local health officer when he receives a card goes and spots the case and puts it under observation. In this instance in the locality mentioned containing these 4 small places there were 16 cases, and they are reporting many new cases a day, so that it is developing into epidemic form. We became a little frightened from that, and we put on this quarantine. We thought we were very negligent and lax in our State, but

after listening to the reports from other States we consider that we are very severe.

We require every ticket agent before selling a ticket to any child under 16 years old, whether from an infected district or not, to demand a health certificate, and that health certificate is pinned to the railroad ticket and taken up by the conductor and checked up by him. Once a week the health certificates are required to be sent in to the State health officer. Now, we have no quarantine against any State outside of South Carolina, but we have a very thorough intrastate quarantine; that is, it does not quarantine, but it certainly discourages travel. These children have to get these certificates before they can buy a ticket, and if they board a train with a certificate not pinned to their ticket they are put off at the next station. The consequence is that it is being made so warm for the health officer that he decided that he had better come to Washington. [Laughter.] The point is, Can we not have some uniform health certificate that will be good in one State as well as another? My friend Dr. Rankin does not require health certificates in his State, and people come from North Carolina to Columbia without them. They then attempt to buy a ticket in Columbia or other place, and they can not get it without a health certificate, so that they are unable to leave. They then get on the trail of the health officer and come down and besiege my office with a whole lot of crying children, and it is right annoying. [Laughter.]

The SECRETARY. South Dakota; Dr. E. B. Jenkins.

Dr. JENKINS. In 1913 South Dakota had 9 cases and 2 deaths; in 1914, 14 cases and 1 death; in 1915, 18 cases and 3 deaths; in 1916, 22 cases and 4 deaths. The cases this year are scattered over 10 counties. Seven of them are in Minnehaha County. Sioux Falls is the largest center of population of South Dakota, with about 22.000 inhabitants. All diseases are handled by the county health officers in South Dakota, and they are instructed to be extra cautious during this epidemic. The people are not alarmed over the prevalence of poliomyelitis, and there is not as much probably in South Dakota as there is in certain Eastern States.

The SECRETARY. Tennessee; Dr. H. H. Shoulders.

Dr. SHOULDERS. Tennessee up to June 30 had 27 cases. In July, up to the 22d, it had 9. There were no cases in the centers of population, all of the cases occurring in rural communities.

The SECRETARY. Texas; Dr. W. B. Collins.

Dr. COLLINS. Mr. Chairman and gentlemen, this disease has not been on the reportable list in Texas by law, but in the last year we have insisted on having it reported, and especially since the excitement began in New York. I find that we had reported in June 6 cases in 6 counties in Texas. In July we had 22 cases in 11 counties,

and up to the 11th of August, when I left home, we had 16 cases. These were all in sparsely-settled counties. None of the larger cities have been infected.

In 1910 and 1911 we had a considerable epidemic of this disease in Texas in some of the larger cities, although nothing like the epidemics reported here, but this year the cases have occurred in the outlying counties. We have a great many counties with small populations distributed over a large area. On this map you will observe that the area extends from the northern portion of the State, in the Panhandle section, as they call it, over 800 miles from one point to another. Not knowing any better way to deal with poliomyelitis than by quarantine, "modified quarantine," as one gentleman here has called it, as head of the State board of health I have isolated the patients, allowing them to be visited and cared for by one member of the family, the rest of the family being kept totally away and allowed to go practically anywhere they please. We have advised cleaning and general sanitary measures and personal hygiene, laying special stress upon mouth and nose hygiene. Not knowing how the disease is carried, by whom, or in what way, I thought to deal with it broadly along the lines indicated.

We have offered no quarantine whatever to the traveling public. The railroads have kindly assisted me in the matter, and on the 1st of June, when things began to get a little scary, organized a railway surgeon's staff, with the view of cooperating with the State of board of health in preventing communicable diseases. We were dealing with Mexico at the time, and also with travel from the East. Our railroad authorities will not sell a ticket now from any infected area in a foreign republic like Mexico or from a foreign State which is known to be infected with any communicable disease, unless the party has a health certificate. He must present a health certificate to the ticket agent. This is issued in duplicate. We issue that certificate in duplicate and the party carries one copy with him stamped by the ticket agent and the other is kept by the officer who gave it for a permanent record. That is done in dealing with the foreign Mexican population, and also in dealing with the traveling public. We merely intend to keep check on travelers and keep them located; at the same time we wish to discourage the coming of the foreign Mexican population, and we think we are doing it, with the help of the Public Health Service, the Army, the Rangers, and everybody on the border.

I do not know that I can say anything further about Texas. We have had poliomyelitis there for 30 years that we know of, with sporadic cases now and then, and we are not able to trace one case to another. It is one of the difficult problems we have to deal with. I myself have been seeing it for 30 years away out in country places

where people did not visit anybody or anybody visit them for months. Possibly it is the result of the season, but I do not know. Is it a seasonal disease, a hot-weather disease, or is it a fall or winter disease? I have not yet heard that discussed.

The CHAIRMAN. I think that will come in a little later on the program.

Dr. COLLINS. I beg your pardon; then, I will just leave that thought with you.

The SECRETARY. Vermont; Dr. H. A. Ladd.

Dr. LADD. Mr. Chairman and gentlemen, I am glad to report that Vermont has no recent cases of infantile paralysis. We find ourselves in the same condition that the epidemic sections will be in a year hence. We had our big epidemic in 1914, with approximately 300 cases in a population of 200,000 people. Only a little over one-half of our State was involved. We find cases cropping out all the time now that evidently had the disease in 1914, and we are discovering cases through atrophy and loss of function in persons who do not know when they had the attack.

In taking up our plans of active treatment in the last year and a half, starting in the first part of 1915, we secured the services of Dr. Robert W. Lovett, of Boston, the orthopedic surgeon, and his assistants, and they came to Vermont and held five clinics at different points in the State. The patients, through their family physicians, were urged to attend these clinics free of charge and have Dr. Lovett prescribe treatment or braces for them or to advise an operation if necessary. At these clinics we had patients who had been afflicted from 2 months to 70 years with all sorts of deformities, and the doctor prescribed for them at that time.

In the latter part of 1915 he came again to the same five cities and examined the patients to ascertain whether they had improved or otherwise, and just recently he has been with us for the third time. We find there is a remarkable improvement in all the cases that have followed his direction. We have two experts now traveling around the State in cars, helping the parents and nurses to care for these cases and follow up the treatment just described, and we are trying in every possible way to assist these cripples. I have in mind several patients who had been paralyzed 9 or 10 years who are now up on crutches, going to school and happy.

We have also established a research laboratory, which is under the direction of the Rockefeller Institute. Dr. Amoss is in charge and has an able assistant in Dr. Taylor. I think that is all I have to say.

Dr. MCDONALD. I should like to ask the gentleman from Vermont what the State is doing for the prevention of the interstate spread of the disease.

Dr. LADD. All children under 16 years of age coming to our State from New York are put under modified quarantine for two weeks, maintained under observation, and kept at their boarding places or homes. At the end of two weeks their noses and throats are irrigated and treated before the quarantine is raised.

The SECRETARY. Virginia; Dr. E. G. Williams.

Dr. WILLIAMS. Mr. Chairman and gentlemen, up to date the only recorded epidemic we have had of poliomyelitis was during the summer of 1908. In July of that year about 25 cases developed at and near Salem, with a population of 2,000 or 3,000. The weather was hot, and as soon as a cool spell started, the latter part of July, the cases ceased. In August another hot spell came on, and two cases were reported. There were no further cases reported. Since then we have had sporadic cases in the State, cases being reported every year and every month during that time. Last year there were more cases during the first six or seven months than in the corresponding months of this year. We have had fewer cases this year than last year.

One characteristic of these cases has been that they have been in isolated places, most of them being off the railroad. They are widely distributed over the State, some in the mountains and some in the tidewater counties. In June we had 10 cases reported from nine counties. Only one county had more than one case. During July there were 19 cases reported. In only two counties was there more than one case, each of these having two cases. We can not attribute any of these cases to importations, except one patient who came to Richmond from Philadelphia and in 36 hours developed the disease. Most of these cases seem to have developed in Virginia, and, as I say, in isolated places. In Lynchburg we have had only one case and in Richmond one; the other cases were in isolated sections.

Poliomyelitis is a reportable disease, and quarantine regulations are practically the same as for scarlet fever.

The SECRETARY. Washington; Dr. T. D. Tuttle.

Dr. TUTTLE. Mr. Chairman and gentlemen, the State of Washington had quite a severe epidemic of poliomyelitis in 1910 and 1911. A report was made on that epidemic. Since then we have had sporadic cases.

Washington this year had three cases, one of which developed in February in the family of a railroad conductor on the west side of the slope of the Cascade Mountains. In June or July another case on the east side of the Cascade Mountains developed. In addition we have had three other cases.

On the 12th of July Dr. McBride, the health officer of Seattle, was examining all passengers to determine their origin. He obtained the address of two children who arrived from Missoula, Mont., and

went out into the country about 5 miles from Seattle to visit their grandmother. On the 14th the children went berrying, a 4-year-old boy with his sister 6 years old, together with an 18-year-old boy. That night the 4-year-old boy was taken sick with stomach symptoms. We require that all these children report if they become ill in any way. The child was apparently well the next day, and the doctor said he could go out the following day. On the next day the doctor found the sister down with a typical attack of anterior poliomyelitis, and the younger child showing a slight attack. On the 19th the health officer found the 18-year-old boy who accompanied them with an attack of the disease.

No other persons have been affected, doubtless because the children were kept in absolute quarantine. I differ with some of those here to-day in regard to quarantine. I do not know how infantile paralysis spreads, and I want to quarantine just as tightly as I can, and I maintain quarantine for eight weeks. All people coming into our State are observed for 20 days after arrival. They are not quarantined. We simply take their addresses and keep them under close observation for 20 days.

The trouble with the card that is sent out from New York is that it is sent to the local health officer. In many cases there is no local health officer, and the postmaster gets it and simply chucks it in the wastebasket.

A large number of the people coming to Washington are in transit to places in California, so that we must not only watch people destined to our State but people traveling through it. Owing to our cooperation with other health authorities, we are able to do this and to notify adjacent places in California, Montana, or wherever the travelers may be going, if patients become ill.

The SECRETARY. West Virginia; Dr. C. R. Weirich.

Dr. WEIRICH. West Virginia has had 8 cases of poliomyelitis in July and August, the first case being in the city of Charleston. The cases have all been sporadic and not traceable to any outside source at all.

The SECRETARY. Wisconsin; Dr. C. A. Harper.

Dr. HARPER. Wisconsin up to the 1st of July of this year reported 17 cases. During the month of July there were 19 cases reported. During the first 15 days of August there were 34 cases reported. Of the 53 cases in July and August, there were 6 deaths.

We have 71 counties in Wisconsin. These cases are distributed among 21 counties. The rural districts show more cases than the urban. The city of Milwaukee, with nearly 400,000 population, has 1 case. Every case is investigated by a deputy State health officer, and only those patients showing paralysis are recorded as infantile

paralysis. Two cases showing paralysis after investigation were proved to be syphilitic and were eliminated.

Our quarantine is absolute for a period of three weeks. In one family there were six children and 3 cases, and in another family six children and 2 cases. In all other families, whether consisting of more than one child or not, there has been only 1 case. None of these, apparently, has been imported. Neither is there any connection, apparently, between the cases.

In 1909 we had nearly 600 cases in about one-fourth of the State; 350 of those cases were investigated, and of these 15.2 per cent were fatal. The area covered by the epidemic in 1909 is comparatively exempt up to date.

In 1913, in the most southwestern county of the State, we had 28 or 30 cases develop from a certain center, and the epidemic at first appeared as though it were going to be severe. It started in the latter part of August and continued into September, and then, with cool weather, it abated. We have been watching that county, and up to date this year no cases have developed.

We do not inspect outsiders who come into the State, but the matter has been under consideration. The United Charities of Chicago have been in the habit of sending large numbers of children into southern and middle Wisconsin for an outing. They asked permission to do so this year. We told them after considering the matter to go on and not to wait for further orders. We do not feel that the disease is always of the epidemic type. Of course with the epidemic we had in 1909 and with the threatened epidemic in 1913, the people are much alarmed. We were freer from the disease in the first six months of this year than we were during the corresponding six months of last year—that is, freer from sporadic cases—but both winter and summer we have had deaths.

The CHAIRMAN. This completes the list of the delegates who were present at the beginning of the calling of the list. I think several health officers have arrived since we began, and the secretary will again call the roll of States, so as to give those who were not here when their States were called opportunity to respond.

The SECRETARY. Florida; Dr. J. Y. Porter.

Dr. PORTER. Mr. Chairman and gentlemen of the conference, my experience with this disease has not been altogether different from that of the rest of delegates. Prior to the present year we had a few scattered cases in Florida each year, and aside from the epidemiological and etiological study and interest which they created, and the general sympathy which arose for parents whose children suffered from paralysis, there was nothing remarkable in the history of the disease, as far as the State board of health is aware. I have seen cases of the disease occurring in a family of six children and

only one child affected. I have seen a case arise in the city of Key West, almost the southernmost point in Florida, with not another case developing. That patient was not particularly isolated.

I have come up here to learn something concerning the disease and not to talk about something that I know nothing of, and I hope that I may get the information before I leave here.

When the disease assumed alarming proportions in the North I exercised supervisory control over the travel of children from the States of the North to Florida. About 85 per cent, I suppose, of all travel into Florida comes through Jacksonville, and the child travelers were inspected by members of my staff and by the trained nurses connected with the State board of health, the temperatures of all children being taken. It was recognized that all children have more or less elevation of temperature from travel fatigue, but where the temperature was over 100, if the destination was Jacksonville, the address was taken and the children kept under observation by competent visiting nurses for at least two weeks. That was for children under 16 years of age. Where they were destined to other towns in the State their addresses were taken and the health officer at the point of destination notified. In case there was no health officer the mayor of the town and municipal authorities were apprised of the fact that the children were coming, and they were kept under observation. So far we have had no cases reported which could in anywise be traced to importations. Of the six cases reported this year I think three can be eliminated as not being poliomyelitis, because they have been investigated, and another is exceedingly doubtful.

The other two cases are interesting from this fact, that they occurred 10 miles in the country at a little town called Perry. The family had not been away from their farm, and the first child, which was 16 months old, had not been in town since its birth. I was doubtful about the case, and sent one of my best men down to investigate. He had some trouble getting there, but he reported that the case could not be anything but poliomyelitis. Now, the interest comes from the fact that another child in the same family was also taken ill. Those are the only two cases of poliomyelitis that I know of positively in Florida in the present year. At the commencement of this excitement in New York and of hysteria in a good many other places, we requested the doctors all through the State to report promptly any cases of infantile paralysis occurring in their practice, and it is needless to say that we are going to have a great many that will turn out not to be poliomyelitis when they are thoroughly investigated. As my good old friend, Dr. Wall, of Tampa, used to say, when a disease is generally prevalent, the physicians seem to think that everything is of that particular order.

I think we are doing everything that is rational and reasonable in our State to prevent any importation, and I have no fear of the disease becoming epidemic if a case or two should be introduced.

The SECRETARY. Louisiana; Dr. Oscar Dowling.

Dr. DOWLING. Mr. Chairman and gentlemen, I have these statistics for Louisiana: In 1911 there were 16 cases in one parish—what I call a parish is what you call a county—in the northern part of the State. There were very few deaths. During that same year six cases occurred in one family. The home of the family adjoined the residence of a lady who was the wife of a banker, and this family packed their grips and started away on the first train. Less than 80 miles from home the oldest child was stricken. They went to a sanitarium, and after reaching the sanitarium the second child was taken. Those are the only instances we have had of more than two cases in the same family.

We have endeavored to keep all children quarantined, to intercept visitors, and to prevent members of the family leaving home, but we find that unless we place a guard at the premises the best of them will go and come in spite of instructions.

There were 26 cases without a single death last year. Fifty-one cases have occurred in Louisiana since the 1st day of January of this year. The large majority occurred within a few months. Of the 51 cases 4 deaths were reported. One was a traveling man from Georgia, 28 years of age. That case was diagnosed after leaving the hospital in New Orleans. When we sent a special representative to investigate it, he was somewhat doubtful about the diagnosis; but there was no question about it. We accepted in good faith the diagnosis of the attending physician.

Another girl, colored, 17 years of age, was diagnosed at the hospital as having infantile paralysis, but later several doctors wrote me and said that the girl had been injured by falling from a height of 14 feet and striking her head, and they were doubtful in their own minds whether the paralysis was due to some other cause than poliomyelitis. Eight of these cases occurred in the city of New Orleans, and I might say that they were imported, most of them, from all over the country. The other cases have occurred in the country. In one little town there were 6 cases following rapidly one after the other. Four cases were reported at one time and the other two in five days thereafter. In this same territory there were 20 cases of typhoid fever. We sent a physician in there and had the community cleaned up. What the effect of the cleaning up was we can not say, but there have been no additional cases of typhoid or infantile paralysis reported from that neighborhood. Two hundred and fifty people were immunized by the use of the typhoid vaccine.

We have had children from New York, and they are being watched closely in communities where we have a local health officer, and by

the State in communities where there is no health officer. Therefore I believe it would be well for the same parties to notify the State board of health, that it may have the local officer or somebody else interested watch such cases.

(The Secretary here completed the calling for the second time of those States for which no representative had responded.)

The SECRETARY. That completes the roll.

The CHAIRMAN. Gentlemen, I think we should assemble promptly at 2 o'clock in order that we may get through with our program.

(At 1.15 o'clock p. m. a recess was taken until 2 o'clock p. m.)

AFTERNOON SESSION, FIRST DAY.

(The conference was called to order after recess by Acting Surg. Gen. A. H. Glennan, chairman.)

The CHAIRMAN. In order to give Dr. Draper a chance to get away for New York we will hear from him on the symptomatology of poliomyelitis.

SYMPTOMATOLOGY OF POLIOMYELITIS.

Dr. DRAPER. Gentlemen of the conference, the commissioner of the State department of health of New York asked me if I would come down, owing to his inability to do so, and say a few words on the subject of the symptomatology of this disease. I imagine that the relationship between the discussion of the symptomatology and the purpose of this meeting is to make possible a better method of preventing the spread of the infection. In the first place, I think it is only fair to say that any quarantine measures which are based solely upon those cases of infantile paralysis which show paralysis are without value, because the cases of infantile paralysis which develop paralysis are much in the minority, and unless the disease is recognized in the nonparalyzed form no quarantine measures which apply only to the paralyzed individuals are adequate. Consequently it behooves all of us to observe with the greatest keenness the instances of sickness in children this summer. Now, in epidemic times we are all alive to the possibilities of sickness in children, and in the reverse of the methods of the law courts we should consider every sick child this summer guilty until proved innocent.

Now, how are we to recognize the nonparalyzed type? A few years ago it seemed an almost impossible thing to do, but as the result of the work done in various parts of the world and different sections of our country, one of the most important contributions being that from the workers in Vermont two years ago, we have gradually been learning to recognize this disease without regard to paralysis. Indeed, one of the men who was working with us down in the Long

Island foci said just before I left, "You know, I do not believe we need pay any attention to paralysis any more." That man is possibly a little extreme, but I firmly believe that before very long we shall be able to recognize this symptomatology and recognize that poliomyelitis is not essentially a paralytic disease. What are the features, then, which stamp it as a definite, clean-cut, clinical type of acute infectious disease? There are certain features of every disease which a skillful physician knows but does not quite know how he knows, and is quite unable to transmit the information to anyone else. You are all perfectly familiar with the picture of a typhoid patient. You can make a diagnosis from the foot of the bed; yet you could not describe exactly what it is you base your diagnosis on. This is true of a great variety of diseases. It is what Dr. Shattuck, of Boston, calls the "clinical hunch." It is a valuable thing, but it should not be final.

Poliomyelitis has a very definite clinical picture, but I can not transmit it to you as it presents itself. It is a definite thing, and if you see a large number of cases you will soon come to feel like the man I spoke of who, just before I left, told me that he does not think we need to look for paralysis. The cases appear as a clean-cut clinical picture of an infection that has an individuality about it. Now, what are the more definite things we can transmit from one to another in the way of recognition?

In the first place, the manner of onset. There are several very definite methods of onset. The first, and perhaps the most common, is when a child previously physically well suddenly complains of a headache, malaise, and has a temperature. Frequently just preceding the more definite symptoms of headache and pains in the bones, joints, and muscles, the child is noticed by the parent to be lying around, the usually active child being found sitting crouched up in a chair or on a sofa. He does not say anything about being sick, but there is an absence of the usual activity. The temperature is found, as a rule, at these observations to be 102° or 103°. Frequently the child is constipated and the mother gives it castor oil, and then the child vomits. There are numerous histories of castor oil followed by vomiting; and then the child seems better. There are many cases that never go any further than that. Cases with exactly the same onset picture, within 12 hours or 24 hours develop a paralysis, but a great many more with that particular onset never show further symptoms, and the thing is passed over casually as a summer upset.

Another form of onset which is fairly common is a long-drawn-out and straggling development. The child is sick and out of sorts, and with no appetite. He may have a little diarrhea, and there is usually

a history of some indiscretion in diet. It is amazing how constant the history of indiscretion of diet is, accompanying these cases. They go along five or six days with irregular temperature of 99½° or 100°, not looking like anything in particular, and then all of a sudden paralysis ensues or the cases clear up.

Then, there is another group which is becoming more and more definite as we learn more of it. Apparently it is getting to be a very frequent one, and we have dubbed it, just among the group of workers down on Long Island, "the dromedary type," because it has two humps. The case starts in much like the first group I have described, with a rise of temperature, gastrointestinal disturbance which runs 24 or 36 hours, and then the entire picture clears up. After a day of two of illness the child is up and running around, apparently as well as ever. Then after two or three days, and we have seen it as long as three days, suddenly there is headache, pain in the neck, and a beautiful picture of meningismus, with a temperature of 103° or 104°. That is a very definite group which is increasing in number as we study the disease.

Finally, there is the fulminating meningeal type, that at first sight resembles cerebrospinal meningitis so closely as to be indistinguishable. They have all of the signs of a very acute meningismus and frequently unconsciousness, delirium, and convulsions.

There are several very valuable aids to the diagnosis determined by physical examination, and among the first of these is the sign which we found quite constantly, pain on anterior flexion of the spine. The textbooks have spoken about the stiff neck and Kernig's sign in poliomyelitis, but examination will convince you, I am sure, that both of these depend apparently on the unwillingness of the patient to permit the spine to be flexed anteriorly because it is painful. When you go to bend the spine you will see the child watching the hand as you put it under the head, and he will stiffen the head and prepare to resist; in the same way if you are going to do a Kernig manipulation you will see the child get ready to resist. Some children, if you lift the shoulders or thighs, immediately stiffen back to prevent it. In other words, there is an instant and constant effort to prevent the bending of the spine. That is an amazingly constant sign in all types of the disease.

Further physical signs which are helpful are the variations in the reflexes. The knee jerks may be absent; they may be much exaggerated; they may be unequal, one knee jerk being very active and another one being absent or diminished. The cutaneous reflexes are practically always undisturbed. Occasionally one finds them somewhat disturbed, either diminished or exaggerated.

So much, then, for the physical signs. Perhaps under this heading might also be grouped the marked tenderness of muscles which also

frequently occurs, and probably, in connection with the anterior flexion pain is the cause of the child's objection to being lifted, even by its mother.

Then there is another very striking characteristic which might be grouped as in the psychic realm, perhaps—the disturbance of temperament. A usually calm, phlegmatic child becomes highly irritable, objecting to everything, a peculiar, whining, resentful irritability manifesting itself. The antithesis of this, a drowsiness or a rapid change from irritability to drowsiness, may also be present, or the child, if disturbed in sleep, suddenly whips around with a snarl and a jerk of the shoulder. All of these things are difficult to describe in words, but they form a very definite clinical picture which belongs to this malady.

Now, the other group of aids in diagnosis are the clinical laboratory procedures. Examination of the blood is of some value in connection with other symptoms, but not alone. In a large number of observations it was found that leucocytosis was the rule. In previous epidemics a leucopenia had been described, but the best evidence up to date apparently shows that leucocytosis is the rule and that the polymorphonuclears are increased at the expense of the lymphocytes. This belongs to infectious diseases in general and does not help to a differential diagnosis from spinal meningitis. Of great assistance in diagnosis, however, is an examination of the spinal fluid, and here we have a real and conclusive help in the vast majority of cases; but we are finding that it must be used with certain definite regard to the stage of the disease. In the fulminating type the fluid appears as slightly hazy, and may or may not be under pressure, containing as high as 2,000 or 3,000 cells per cubic millimeter, down to as low as 10 or 15. These cells in the very earliest stage—and by that I mean within four or five hours from the onset of symptoms—are of the large endothelioid multilobed type, with a smaller number of lymphocytes. As the disease progresses, the appearance of the cells changes and the larger cells give place to the small lymphocyte type, so that we have almost 100 per cent small lymphocytes. The globulin is usually low or negative, but within the first day or two the globulin content increases rapidly, and then within 24 hours you have a fairly heavy or very heavy globulin reaction.

In our recent work we have found several interesting things in regard to the spinal fluid. The first of these is just merely a corroboration of the work done by Dr. Fraser in the Vermont epidemic. The spinal fluid in many cases at the very outset of the disease—that is, within a few hours of the first symptoms—gives no indication at all of the character of the infection. Certainly, if you make your lumbar puncture within four or five hours, the spinal fluid is likely to show nothing at all, but if you repeat the lumbar puncture within

16 or 24 hours the cell count may be very large. We have had several very extraordinary instances of the value of following the disease by repeated punctures. For instance, a case comes down in a family where there is another patient. I am describing now an instance that occurred last week. One child was down with the disease and another boy became ill. A puncture was made within two or three hours of the onset, which indicated no change in the spinal fluid. Then after 12 hours another puncture was made, and there was a marked increase of cells. In this instance there was a question whether we should use the serum of a recovered case. The cell increase was not above 100, so that it was decided to wait and puncture again. At the end of a second 12 hours another puncture was done. and the fluid was found to have returned to normal. The following day the temperature was normal and the child was up and about as usual. If those punctures had not been done the case would not have been called positive and that boy would have gone about spreading the disease. Since this instance developed we have had another case in which multiple puncture has demonstrated its value. It seems to me that State health officers can perform no more worthy function than to urge the profession at large to use lumbar puncture, particularly as it is a perfectly harmless procedure and very easily carried out. This will mean the recognition of many cases at a time when they are most dangerous to the community.

Now, I have not said anything about the paralysis, and I do not propose to do so, because I do not want to leave, any more than is avoidable, the impression in the minds of this gathering that the paralysis is important, except to the individual. As I understand it, this is a meeting to discuss means to protect the community at large, and the way to protect the community at large is to recognize the cases which are a menace. The paralyzed case automatically ceases to be a menace with the onset of paralysis. The early recognition of cases is possible, and essential; the quarantine of paralyzed cases alone is inadequate. [Applause.]

Dr. FRANTZ. May I ask the doctor how long the tenderness of the spine lasts?

Dr. DRAPER. The tenderness of the spine may last a long time. It varies greatly in different individuals. I have seen it last as long as a month; but the tenderness of the extremities is more apt to outlast the tenderness of the spine.

Dr. FRANTZ. What proportion of these cases have paralysis?

Dr. DRAPER. We are very much impressed with the large number of cases that do not have paralysis. We have surprisingly few.

Dr. EMERSON. They are uncommon.

Dr. DRAPER. In the rural districts paralysis has been surprisingly uncommon. The only case I have seen is one, I think, of syphilitic infection.

Dr. WOLFF. I should like to ask the doctor if he has made any investigation as to the change in the reaction of the spinal fluid in the progress of the disease; that is, whether the normal outline of the spinal fluid on puncture is changed during the progress of the infection.

Dr. DRAPER. We have not made any observations of that nature.

Dr. WOLFF. I have found that extremely characteristic in spinal meningitis in a large number of cases; that is, in the course of the disease the outline of the reaction of the fluid becomes more and more acid as the disease progressed toward a fatal termination, and I think it is a very important thing to-day to determine.

Dr. OPPENHEIMER. There have been a number of operations in Brooklyn and New York. What has been the position of the operated cases in connection with new cases? Has any notice been taken of that?

Dr. DRAPER. Do you mean in regard to their infectivity?

Dr. OPPENHEIMER. Yes.

Dr. DRAPER. I have no statistics on that. To answer your question directly, the virus retains its infectivity.

Dr. OPPENHEIMER. It retains its infectivity?

Dr. DRAPER. Yes. There have been cases in which the virus was active five months after the disease; and in one other case, which is not quite clear because of the fact that the individual may have had two attacks, at a period of two years following the first attack it was active.

Dr. SWARTS. Did I understand the doctor to say that the virus was noninfective after the case was cured?

Dr. OPPENHEIMER. No, sir; by no means.

Dr. DRAPER. There is only one instance which I have reported, and in that case it was not certain that the first attack had been of the same disease.

Dr. FULTON. What per cent of your cases, or those in New York, have occurred in the colored race?

Dr. DRAPER. I will have to refer that to Commissioner Emerson.

Dr. EMERSON. Up to the last three weeks there were so small a number of cases among colored people that we suspected that there was a racial insusceptibility to the disease. Since then they have been coming in so rapidly that it is apparent there is no difference in New York between the colored people and other groups.

Dr. YOUNG. I should like to ask Dr. Draper if he will tell us whether the early changes in the eye reaction are of any help in the diagnosis.

Dr. DRAPER. Do you mean the pupillary?

Dr. YOUNG. Yes; the pupillary.

Dr. DRAPER. The pupillary changes we have seen have been only in connection with other changes, and I have never observed any changes in the more usual types of disease.

Dr. COLLINS. Are you sure about the immunity offered by an attack against subsequent attacks?

Dr. DRAPER. All the evidence so far seems to point to that fact, and also the fact of the high neutralizing power of the blood serum of people who have the disease upon the virus. This has been demonstrated in a certain number of people who have had the disease, and it has also been demonstrated in a number of individuals who have not had the disease. Now, whether that neutralizing power depends upon a previous attack which has not been recognized has not been determined, there being no way of deciding, but the fact that there have been reported only two possible cases of a second attack is rather significant.

Dr. PARLETT. Has any investigation been made involving the milk supply of infected families? The reason I ask is because in isolated cases there is apparently no means of tracing their origin, and I thought perhaps an infected udder or something of the sort might be responsible.

Dr. DRAPER. There is no evidence that cattle are subject to the disease. The rôle of milk is apparently associated with the milk handlers, if milk has anything to do with it.

The CHAIRMAN. I will ask Dr. Frost to speak to us on this subject.

Dr. FROST. Dr. Draper, it seems to me, has succeeded admirably in the difficult task of giving a clear clinical picture of the disease. I think he has succeeded better in presenting a picture of nonparalytic poliomyelitis than anyone I have before heard attempt it. Wickman, in Sweden, first distinctly called attention to the concurrent occurrence of nonparalyzed with paralyzed cases, showing all grades, from slight, transient paresis down to the cases Dr. Draper has described. Physicians generally have been very reluctant to admit their existence. They are quite reluctant to admit the possibility of a diagnosis on what appears to them such slight evidence. I think there is a growing tendency to get away from that skepticism and to agree heartily with the diagnosis which was proved, even prior to the proof now furnished by lumbar puncture, which thoroughly establishes the lesion.

As to just the part that these cases play in an epidemic, and as to their proportion to the paralytic cases, I think that is very much a matter of conjecture. Speaking from such experience as I have had personally, my first impression is that the proportion of nonparalyzed cases seen in any community is dependent upon the thorough-

ness with which one studies the community. In a community where you become acquainted with all the physicians and see all the cases, making practically a house-to-house inspection, you find a relatively large proportion, often more than double the paralyzed cases. I am inclined to believe, however—and I think it will eventually be proven—that, even aside from the thoroughness of the study, there is in different epidemics a difference in the proportion of nonparalyzed cases which come up over the border line of clinical recognition. Where you have a large number of cases affecting a large proportion of the population with severe symptoms you have a relatively large proportion of light infections clinically recognizable. On the other hand, where you have a thin, scattering epidemic, as, for instance, in Cincinnati, where there were but 100 cases among 400,000 people, light infections fail of discovery.

Just one word as to what effect this should have on our consideration of the prevalence of the disease. Take the case of other people being in the same family with paralyzed cases. I have some figures from an epidemic in Iowa. If we count only the clearly paralyzed cases, 5½ per cent of children under 15 associated directly with paralyzed cases subsequently developed frank paralytic disease. If we count in the clinically recognizable nonparalyzed cases the percentage was almost doubled. If we count in also the cases regarded as suspicious but which could not be examined at the time, this would again have the effect of doubling the 11 per cent to 22 per cent, giving an apparent contagiousness on that basis approximating that of scarlet fever or diphtheria. In other words, by including all cases we have quadrupled the number infected and have brought poliomyelitis up to the appearance of a contagious rather than a rarely contagious disease.

As to the possibility of recognizing these cases by general practitioners, I think a great deal more is being done now than a few years ago, and I believe such cases will be more generally recognized in another few years. It would seem at present, viewed from a public-health standpoint, that we should not wait for final diagnosis at all, but that we should isolate all cases of illness in children simply on suspicion. If we wait for a definite diagnosis, we may have to wait several days. Lumbar puncture is not going to be practiced generally in rural communities, and the doctors must isolate on suspicion. [Applause.]

The CHAIRMAN. If there is no more discussion, we want to proceed to the subject of the prevention of the interstate spread of poliomyelitis, and I will ask Senior Surg. Charles E. Banks to address us on that aspect of the problem.

PREVENTION OF THE INTERSTATE SPREAD OF POLIOMYELITIS.

Dr. BANKS. The work which the officers of the service are doing is performed by a system of notification and inspection of the children departing from New York City. This is being accomplished by the aid of the health commissioner of New York City, who has established a system of district health offices where residents desiring to leave New York City apply for certification as to whether their premises are free from poliomyelitis. The traveler then comes to the depot or ferry, the children being then certified as apparently well. A duplicate of the card issued to the traveler is mailed immediately to the health officer of the town to which he is destined. That gives the health officer an opportunity of locating these people on their arrival and taking whatever measures he deems necessary for their isolation. We have now 36 officers stationed at the various depots and ferries in New York City, on what I might call the "two-platoon" system, working 13 hours a day. We also take care of such automobile travel as we can reach, and we can reach everything except travel going north into northern New York or into eastern Connecticut. Wherever they cross by ferry we are able to inspect them, the same as we do travelers by train or by boat.

We are also covering every boat exit from New York. While I am aware that there are many avenues of escape from Greater New York, yet I think we get a very large proportion of travelers through the aid of the railroads, which have issued definite instructions under the existing quarantine regulations to allow no one to board a train or a boat without our certificate. That our system is sufficiently close we have ample evidence, because of the complaints of travelers who are unable to get through without our certificate—passengers who come very late at night or early in the morning. In fact, one of the great values of our work is through the cooperation of the railroads, and I wish to express my appreciation of their conformity to the requirements. I do not know that there is anything further that I can say, but I shall be very glad to answer any questions as to our methods. I see you have said here all travelers under 16. We have certified so far about 30,000 children and about 17,000 adults. In explaining this fact, I would say that these adults request this certificate from us for the purpose of enabling them to travel. We do not require it, but many adults insist on taking it, so that they will not be held up at towns or cities where a very close quarantine is established.

This plan has been in operation since July 18, and we are certifying about 1,500 children a day. They are examined by our officers, and quite a number of cases have been turned back on account of

apparent illness. A health officer getting a notification from us can be assured that the premises occupied by the traveler are free from poliomyelitis, and that in entraining or embarking on a boat the child is apparently well. Beyond that we can not go, because undoubtedly many cases will get by us in the incubative stage, and the best we have been able to do is to give the health officer an opportunity to locate the travelers from New York City.

Dr. FRANTZ. I understand you are from New York?

Dr. BANKS. Yes.

Dr. FRANTZ. You send the notice to the health officer of the district to which the party is going?

Dr. BANKS. Yes.

Dr. FRANTZ. I would like to increase your labor 50 or 100 per cent by having you send your notices to the State boards of health of the respective States, unless they go to cities which are large cities, over 10,000 or 20,000 population. There are many small districts where there are no health officers and no local boards of health, and persons who go there escape entirely the observation of any State health official.

Dr. BRACKEN. I would like to reduce the work of your board about 90 per cent by asking you to make all of your reports to the State health officials and not to the local health officials. We know our local health officials, and we know whether they are efficient or not, and if all those reports came to us it would be for us to see that they should go to the different points in the State. I know that notifications have come into my State, but I have no information concerning them. Now, I am the man who ought to know. I ought to be in position to give the information to other sections of the State, and I make the request that all of these notifications go to the State health officer, and that he be left to distribute them to the local health officers.

Dr. TUTTLE. I would like to duplicate the request of Dr. Bracken. I would say that I do not know that a card has come into the State of Washington, yet we collect 25 to 35 passengers there every day, children and adults combined. We require a report on all. Yet I have never heard of a card coming. If they were sent to me I could have my officer do as I tell him, as we have telegraph and telephone facilities in Washington.

Dr. BURKART. I want to indorse what Dr. Bracken says. Officially we are not cognizant of any person in Michigan who came from New York. By accident, yesterday I saw one of your cards. It came to the health officer of the city of Lansing. It was the first intimation I had that you were adopting that method.

Dr. DRAKE. Mr. Chairman, I wish also to indorse what Dr. Bracken and the other gentlemen have said. We are advised occa-

sionally of persons coming into Illinois from New York. We have no official notification of it, however, and only recently I took occasion to issue an additional order that all persons arriving in the State of Illinois with children under 16 years of age shall make their presence known to the local health officer within six hours after arrival, the local health officer being obliged to notify the State board of health. I think that we could get down to this a great deal better and a great deal more efficiently if the notification were sent not only to the local health officer, but if a carbon copy of it could be sent to the State board of health. If a carbon copy is sent to the State board of health we will have it as a record. There will be some saving of time if it also goes to the local health officer, of course. In many of our communities in Illinois we have not an efficient health organization. We have the butcher, the baker, and the candlestick maker constituting a board of health. They know nothing about the handling of these cases, really, after they do get a notification, and I believe that the service can be made very much more efficient if we can get a notification to the State health officer as well.

Dr. CARR. Mr. Chairman, it seems unanimous, and Nebraska wants to second the motion of Dr. Bracken that this be done hereafter.

SEVERAL MEMBERS. Second the motion.

Dr. BRACKEN. Mr. Chairman, I do not want to concede the amendment suggested by Dr. Drake, that a carbon copy should be sent to the State board of health. I want the original sent there.

Dr. DRAKE. If the carbon copy goes to the local health officer, you will get the original. Either way.

Dr. ROBERG. We have, with British Columbia, thrashed this whole thing out. We agreed on the regulation, and we put the proposition up to the railroad people, and they willingly indorsed it and put it through. If I am not out of order, I would move to refer this question to a committee, so that this whole matter may be thrashed out and presented in good form.

The CHAIRMAN. The Chair thinks that is a good suggestion. I will ask Dr. John S. Fulton, of Maryland, to discuss this matter.

Dr. FULTON. Mr. Chairman, I did not rise for the purpose of opening the discussion at all, but I am exceedingly interested in it, because it strikes me we have gotten very close to the kernel of our difficulties. I wish to call your attention to the state of confusion in which we all are at this time. We are all setting afloat throughout the United States, more or less, in the hands of passengers on railroad trains, a number of certificates of all kinds, and permits are being issued with apparently no official designation. Such, indeed, is the case of a very large proportion of them. I understand that those

issued by the Public Health Service have official designation in the State to which the traffic is going, but in general they are a very small part of the certificates and permits afloat, which are sometimes of questionable authority and often of no authority whatever. There is a situation of the greatest confusion.

We have discussed this matter in Maryland very carefully and with some solicitude, since Maryland, Delaware, and West Virginia are now in a sense the barrier States, and the question has been put up to us, What shall we do? In Maryland, I think we are very clearly of the opinion that the prevention of the interstate spread of the disease is the function of the Federal Government, and that we ought all to be relieved of State duty in the matter of interstate communication. That is our opinion in Maryland. At all events, it is a situation out of which order must be evolved.

If I have your permission I should like to make a motion that a committee on the prevention of the interstate spread of poliomyelitis be formed by this conference at as early an hour as is practicable.

Dr. COLLINS. I second the motion.

The CHAIRMAN. Is that acceptable to you, Dr. Bracken?

Dr. BRACKEN. That does not apply to my motion.

Dr. FULTON. I did not understand that there was a prior motion. I did not understand that Dr. Bracken made a motion.

The SECRETARY. The motion of Dr. Fulton is that a committee be appointed on the prevention of the interstate spread of poliomyelitis.

Dr. FULTON. Of five or three, I should say.

The CHAIRMAN. Is there a second to that motion?

SEVERAL MEMBERS. Second the motion.

Dr. DRAKE. Before you put that motion let me ask this question. Does this apply only to health certificates originating from travelers from New York?

The CHAIRMAN. It applies to every State.

The SECRETARY. As I understand the motion made by Dr. Fulton, he wishes a committee appointed to which shall be referred all matters relative to the prevention of the interstate spread of poliomyelitis, either from New York or from any other place in the country.

Dr. FULTON. Yes; that is right.

Dr. EMERSON. I submit we shall be leading ourselves into a sanitary inconsistency if we discuss this from the point of view of children under 16. Although Dr. Draper did not refer to it, and it has not been spoken of yet particularly here, it is quite obvious that there are adult carriers. It is perfectly certain that there are people who have been in constant personal contact with active cases of the disease who are due for an undetermined period to carry and spread the infection. There have been a sufficient number of cases within the

city of New York to make it quite apparent that the only obvious means of communication of infection to new foci has been through adults who have come from immediate, persistent personal contact with cases of the disease.

That is the condition we have found within the city; and yet I quite agree with Dr. Banks when he said he felt that their activity should be limited, at least in the beginning of this system, to certification of children under 16. If you do not limit yourself to that, you will find yourself facing the immobilization of your adult population. There are 500,000 people in New York City who travel from New York to other States once every 24 hours. The suburban traffic of New York would then be subject to the limitation of certificates every time such persons went from the Borough of Manhattan to their homes in Connecticut or in New Jersey. I do not want to predict or foreshadow the conclusions of the interstate committee, which will doubtless be conservative and consistent, but it is obvious that we are going to leave many holes in our armor of protection if we do not include adult carriers. Whether or not those adult carriers have suffered from the disease themselves, it is perfectly apparent that adults who have been in contact with cases may spread and have spread the disease during the present epidemic. We have not felt, however, that we had any right to put our finger on a healthy adult, and say, "You must be limited in your movements." Until we have tested their capacity for carrying the disease I do not believe we shall be able to establish consistent sanitary regulations.

Dr. COLLINS. I should like to suggest, in order to avoid all error, that Dr. Emerson be made a member of that committee.

The CHAIRMAN. Dr. Emerson is not an official member of this conference.

Dr. COLLINS. Let us make him so, ex officio.

Dr. EMERSON. Other members of that committee have all the information that I have, and it would be most improper, it seems to me, for a city official to be put in that position. They have all the information in their hands, and I should beg to be excused from that; not that I am not willing to work, but I do not think that this is either necessary or proper.

Dr. BRACKEN. Just a moment, on the motion. I want to favor this motion of Dr. Fulton's, and probably my remarks are not necessary here; but it is possible that in putting this motion it will not be necessary for me to put another, so I will let the thing go as a motion now and then make my motion later if I want to.

The CHAIRMAN. The motion is that a committee be appointed on means to be taken to prevent the interstate spread of poliomyelitis. That is your motion, I believe?

Dr. FULTON. Yes.

(The question was taken, and the motion was unanimously agreed to.)

Dr. BRACKEN. Now, Mr. Chairman, I want to call the attention of this conference to the fact that about 1910, I think, there was an arrangement by which reports were to be made from State to State of cases. Those reports have been made by some States, and have always been forwarded to the State health officials. Therefore I move you, as bearing on this one point, that from this time on all reports bearing on this subject be forwarded directly to the executive officer of the State board of health. This has nothing to do with the situation on the Pacific coast, but it has simply to do with those reports which are coming in to the States—that they should in every instance go to the State health officer.

(The motion was seconded.)

Dr. BANKS. I think there will be no question about this. We can as easily mail these notices to the State officers as to the local health officers. We have been mailing them to the local destinations of the travelers, and we can as easily arrange to send them to the State health officers, so that it is not an addition to my work but a lessening of it.

Dr. TUTTLE. Would it add materially to your work if you turned those notices over to the telegraph company and asked them to wire them at our expense?

Dr. BANKS. Where are you located?

Dr. TUTTLE. In Washington. We are willing to pay for the telegraphing.

Dr. BANKS. I presume the telegraph office would take those dispatches.

Dr. TUTTLE. I have a frank from the telegraph company authorizing me to send any telegram direct to my office.

Dr. WOODWARD. I move that the question on the motion in reference to prevention of interstate communication be referred to the committee on interstate measures. We have a long and busy program, and that is a matter that must be considered at length.

The CHAIRMAN. Without objection, it will be referred to the committee on interstate measures. Next on the program is "The research problems in poliomyelitis." I should like to call on Dr. Lavinder to speak on that subject. Before Dr. Lavinder begins I should like to say that there are a number of railroad men here who would like to consult with the members of the committee on interstate features when they are ready to talk with them. I suppose that committee will be appointed a little later.

RESEARCH PROBLEMS IN POLIOMYELITIS.

Dr. LAVINDER. Gentlemen, I have very little to say. Such work as we have done is by no means in such condition that we are ready to present results. I think it should be made clear to this meeting, however, the exact position the Public Health Service is occupying in this epidemic in New York City, since I do not think it is generally understood. There are two groups of officers of the Public Health Service at work in New York City. One small group, of whom I happen to be the senior, is associated with me, and is entirely engaged in scientific work. The other group, under Dr. Banks, is entirely engaged in interstate notification measures.

The group of officers with which I have been associated have changed their plans somewhat—they have been forced to—several times. There are, of course, two sides to any scientific investigation. One is the laboratory side and the other is the epidemiologic side. Originally, I do not think we all realized what an immense epidemic of poliomyelitis we had to contend with, and we had planned to do certain laboratory work in New York; but when we realized what we were dealing with this laboratory work was very largely shifted to the Hygienic Laboratory here in Washington, under Dr. McCoy, and since that time we have done very little laboratory work other than to cooperate with Dr. McCoy in securing certain material for his use.

We have also taken some interest in two other matters through the cooperation of Dr. Emerson and his department and working with him. We have been doing a small amount of entomological investigation. Dr. Emerson has one or two entomologists in his department and we have one, and these gentlemen have recently begun some surveys, practically nothing more.

In addition to that we have also taken into consideration sick and paralyzed domestic animals, and have made investigations into that subject, and with Dr. McCoy will continue them.

The biggest part of our work has been epidemiologic in character, and through the kindness of the commissioner, Dr. Emerson, whom I wish to thank, for he has been most courteous, we have been able to go into the city department of health's office and obtain all of their data. At present we have men in Dr. Emerson's office who are collecting the data he secures, and we are trying to tabulate and make use of that data in a study of the New York City situation. In addition we have taken the whole of Staten Island, and are engaged in an intensive epidemiologic study in that section. We selected that borough because it presented many features of interest and was favorable from an administrative standpoint, it being manifestly impossible for us to do this work in such congested districts as parts of Brooklyn and Manhattan.

Then, finally, we have broadened our work, and through cooperation with certain State health officers surrounding New York City, in Connecticut, Rhode Island, and Massachusetts, we are getting reports of all their cases, and have detailed officers in two or three of these States to make intensive studies of certain selected cases or selected sites. When we get all of this data together and correlated, as it can be, with other observations as to poliomyelitis in the United States, we will have an immense amount of material, and we believe such observations may show something well worth while.

In connection with our outside studies I think it is a matter of some importance that I should say to the State health officers that in doing their work I think some effort ought to be made toward uniformity of statistics collected. If some arrangement of that kind could be made it would be of great advantage. For example, when you are collecting statistics with regard to age incidence, if every State could agree to certain years, instead of one State taking the years from 3 to 5 and another from 1 to 5, the statistics would be of far more value. Statistics when gathered in that way are not comparable.

In the States in which we are working we are trying to get such data compiled so that we may have figures which can be compared. I have with me three or four blank forms which will show you just what we are using, both in our case cards and the epidemiologic studies. This blue card is the one used by Dr. Emerson in his department, and this white card is the one on which we are obtaining our data from his cards; in addition we have two case cards for much more extensive work, one of which was adopted by a conference of this kind in 1911, and the other has been modified somewhat and is more extensive in certain particulars. This one is being used in the work in New York now.

The CHAIRMAN. I will ask Dr. G. W. McCoy, of the Public Health Service, to open the discussion. Dr. McCoy is director of the Hygienic Laboratory of the Public Health Service.

Dr. MCCOY. Our laboratory work is being carried on in a general way in accordance with a plan outlined at a conference which was held in New York, at Dr. Emerson's invitation, on August 3 and 4.

It was agreed that the important things to do were to determine the relation of paralytic diseases of animals to poliomyelitis, to determine the susceptibility of laboratory animals and domestic animals, to endeavor to cultivate the organism, and, if possible, to devise some better method for detecting the presence of virus than the one we have now, namely, the inoculation of monkeys. Insect transmission experiments are also contemplated.

Our own work is just starting, and there is nothing to say about it at present.

The SECRETARY. Mr. Chairman, it seems to me that the conference should take advantage of the suggestion that was made by Dr. Lavinder—that is, in regard to a uniform method of collecting statistics concerning poliomyelitis—and I will therefore move that the Chair appoint a committee of five to make a report to the conference on uniform methods of collecting statistics regarding poliomyelitis.

Dr. RANKIN. Mr. Chairman, I will ask Dr. Rucker if he could not enlarge his motion to include the submission by the committee of standard epidemiological forms for obtaining these facts?

The CHAIRMAN. That is what I understood the motion to be.

The SECRETARY. Yes.

Dr. CARR. I second the motion of Dr. Rucker.

Dr. WOLFF. Why not let this apply to all these matters?

The SECRETARY. I am afraid that would be too broad.

The CHAIRMAN. It has been moved and seconded that a committee of five be appointed on uniform methods of collecting statistics regarding poliomyelitis.

(The motion was seconded, and there were cries of "Question." The question was thereupon taken, and the motion was agreed to.)

Dr. BRACKEN. Mr. Chairman, I make the following motion: Moved, that a committee of three be appointed on measures to be taken to prevent the spread of poliomyelitis in the respective States. That would be intrastate. It may be the same committee; it is immaterial to me. These committees ought to be appointed right away, and ought to have some sort of report for us very soon.

The CHAIRMAN. It is moved and seconded that a committee be appointed on measures to prevent the intrastate spread of poliomyelitis.

Dr. BRACKEN. That this be referred to a committee to take up both interstate and intrastate matters.

The CHAIRMAN. If there is no objection, that will be done.

Dr. DRAKE. If it is not amiss at this time, I should like to offer a suggestion that Dr. Rucker be a member of the committee on interstate forms. I offer that suggestion because I know that Dr. Rucker will be of great help and value to that committee.

The CHAIRMAN. I think Dr. Emerson would like to say something about this.

Dr. EMERSON. I must apologize for getting on my feet again, but there are certain research studies under way which I think you might be interested in, because others might succeed where we have failed.

Because of the discussion in regard to milk, and owing to the fact that the New York City milk supply is entirely pasteurized, it seemed to us worth while to take one borough and study every case in that borough as if it were a case of typhoid fever, to determine if there is any conceivable and detectable connection between persons on the milk farms up State from which the supply is obtained

and the presence of cases of the disease in the city. That study is being made in the Borough of The Bronx, and will supplement the studies of the Public Health Service officers in the same borough. We can ascertain from our records the source of the milk for the past month and we can locate the milk that was delivered to any particular case. This is an attempt to put an end to all doubt as to the possibility of this source of infection.

Then, through the Rockefeller Foundation fund, a study has been made as to the effect of secondary contact in the epidemiology of the disease. Dr. Doty, with the assistance of 25 or 30 nurses, five doctors, and the necessary office force of clerks, has been following the cases as they are reported each day, and up to the present time they have brought in a tentative report showing that in 30 per cent of the cases they find an obvious previous contact with an active case. Whether or not this figure will be maintained, we are not sure. These investigators go to the house and ascertain all of the people the patient has been in contact with for some days previous, and just where the child has been; in this way they also dig up a few previously undetected cases.

Then there are clinical studies conducted in the hospitals to see if we can get any light at all upon the type of children who are susceptible to this disease. As you have heard, the incidence of secondary cases is about the same as the incidence in scarlet fever. We have worked that out ourselves. For the first 2,000 cases in Brooklyn the incidence of secondary cases in the main is almost identical with the incidence in scarlet fever in the same borough among the same type of people. So that we must consider how far we may possibly detect clinically the susceptible types of children. Anybody who goes through a hospital such as Willard Parker Hospital, with 900 children, will get an impression that these children are different physically from other children. That study is being made for the purpose of helping the clinical work.

There is only one other study that is going on, and that is an investigation of the results of different therapeutic procedures. Publicity has aided us in getting a very large amount of blood from recovered cases, both those recently recovered and those where the recovery dates back 30 or 40 years, and the serum from such cases is being used in the spinal canal, after withdrawing the spinal fluid. The results will take months to work out. Let me warn you that there are no reliable conclusions at the present time. We have many patients apparently severely ill who clear up almost miraculously by being allowed to stay in bed 24 hours. On the other hand, cases of bulbar involvement have recovered after the use of the immune serum, whereas we expect to see those go on to complete respiratory

paralysis. We are doing our best to use the clinical material as it comes in for controlled clinical observations of these cases.

I can not sit down, Mr. Chairman, without expressing my thanks personally for the very great courtesy and discretion shown by Public Health Service officers. If any health officer wonders whether he is going to be accused of crying for help if he calls upon the Public Health Service, my experience is that if there is one thing that will add to the confidence of the community in the work being done it is the character of work and the character of personal relations of the Public Health Service officers. What the Public Health Service has done in its work for us has been splendid. [Applause.]

The CHAIRMAN. Thank you, Dr. Emerson; to have been of service is most gratifying.

COMMITTEE APPOINTMENTS.

The committee on uniform methods of collecting statistics regarding the spread of poliomyelitis will consist of Dr. Lavinder, Dr. Woodward, Dr. Drake, Dr. Young, and Dr. Frost.

The committee on measures to be taken to prevent the interstate spread of poliomyelitis will consist of Dr. Fulton, Dr. Tuttle, Dr. Williams, Dr. Bracken, and Dr. Banks.

Gentlemen, the next subject will be the epidemiology of poliomyelitis, and I will ask Dr. Frost to let us hear from him.

EPIDEMIOLOGY OF POLIOMYELITIS.

Dr. FROST. Mr. Chairman and gentlemen, I hardly know how to start a discussion of such a broad subject as the epidemiology of a disease so peculiar and complicated as poliomyelitis. Any broad statement must be subject to exceptions, and in any event we arrive at broad generalizations through the summation of our individual experiences. I am afraid that this broad generalization will not give us the picture one gets from the consideration of isolated facts and proved instances, but I will try to run over as rapidly as I can what seem to be the general, outstanding facts in the epidemiology of this puzzling disease. While it is not part of the epidemiology, I do not think we can sensibly discuss the epidemiologic data without at least taking cognizance of what we know experimentally. I shall not go into that in detail, but would like to summarize what we have learned from experiment.

Beginning in 1909 we found that poliomyelitis is transmissible to various kinds of monkeys, and occasionally to rabbits. So far it has not been shown that other animals are susceptible. The only way we have of demonstrating the virus of poliomyelitis is by inoculating monkeys and producing the characteristic effects. Without

going into details the following facts are outstanding. The virus has already been demonstrated as present in the nasal and intestinal secretions of people with poliomyelitis, and in comparatively few examinations of recovered cases some weeks or some months after the disappearance of acute symptoms, we have still found the virus present. Those cases are not numerous, and it leads us to the question of automatic carriers. It has been demonstrated that in some instances the virus is present in the nasal discharges, and with somewhat less certainty, in the intestinal secretions, of persons entirely well, who have been in contact with acute cases. Most of the carriers we have experimentally shown have not been children, but adults.

The other experimental fact of the greatest importance is probably the avenue through which we can infect animals. We can infect monkeys by injecting a portion of the spinal cord into almost any part of the body; most promptly by injecting it into the brain or into a nerve sheath, and not infrequently by introducing it directly into the nasal mucous membrane. Taking the experimental data alone, the introduction through a mucous membrane gives us a definite picture of a contagious disease.

A few instances have been reported of experimental infection of monkeys apparently caused by biting insects, but they have not been thoroughly confirmed. To consider what we actually see in the occurrence of the disease might lead us very readily to a different conclusion as to its contagiousness. We have had several eras, we might say, in our experience with poliomyelitis.

Recognized since about 1840, the disease had occurred since then up to the middle eighties only sporadically, with occasionally some 8 or 10 cases in a small village. Then in the middle eighties, principally in Sweden, we began to notice larger groups of cases, and then we got the clinical picture we now have and a conception of the more severe constitutional symptoms. From that time on to 1905 we had increasingly larger epidemics. The year 1905 marked a new era in the epidemiology of the disease. We then had an epidemic spreading over Sweden, with a total of about a thousand cases. From that time to the present marks another era of practically pandemic prevalence. In 1907 we had an epidemic in New York City, not reported because the disease was not at that time reportable. Following that we had epidemics in 1908 in Massachusetts, in 1909 in Nebraska, and, I believe, in Minnesota and Massachusetts, and in 1910 a widespread prevalence of the infection. Since then we have had numerous cases every year.

Our statistics of the endemic prevalence date back to 1910, but since then we can say that the disease has occurred in every State of the United States, and in every month of the year. This year, I believe, is going to mark another era, because we are now having an epidemic

which, in comparison to what we have previously had, bears about the same relation as the epidemic of 1907 or 1910 to former epidemics.

To repeat briefly what seem to be the salient features: We have the picture of widespread infection, widely scattered, occurring now and then in epidemics of small size, which characteristically are scattered and irregular. For instance, in 1907 there was an epidemic in New York and we did not have an epidemic in Philadelphia. We have at various times had epidemics in New York and Philadelphia, and we have had them in New York and Washington and not in other cities. Characteristically then we have an irregular spread. I think the same thing is shown this year in the reports we have received from various States. We have a characteristic seasonal prevalence, usually in the spring and running into the late summer and fall, about the season when infantile diarrheas are prevalent, and not in the season of ordinary respiratory diseases. I must say, however, that the disease must be largely independent of climatic and seasonal differences. We have records of epidemics beginning in the spring and stopping in the fall and of others beginning late in the summer and running into the winter. We have no such relation with the seasons as we have in yellow fever, which always stops when it becomes too cold for mosquitoes.

Another fact which seems to be uniform is that we have our greatest incidence in proportion to the population in small villages and rural communities. That, I believe, is a universally accepted fact. Take 100,000 people in rural districts or a few small villages, and they are likely to have more intense epidemics than an equal number of people collected together in a large city. Still more striking perhaps is that the total incidence of cases is always exceedingly small in any large group of population compared to the epidemics of our more common infectious diseases. An incidence of 1 case in 1,000 of population or 1 in 2,000 gives us an epidemic of poliomyelitis. This would be only a small endemic incidence for any other disease. In New York we are now getting a much higher incidence, which is a new experience; but even there we are getting only 1 in 750, while in Richmond, which has 100,000 people, we are getting 1 in 450. Now, characteristically, after reaching that small incidence the epidemic has passed out of that area. Already we are noticing that in the groups of 100,000 the epidemic has reached its highest point and is declining. We can not account for that on the ground of any climatic change, because in adjacent territory it is still on the increase, under the same general meteorological conditions. We can hardly account for it on the ground of the removal of the sources of infection, because we have in the territory a large number of cases that must be infectious. It is very difficult to explain it except on the ground of the thinning out of the susceptible population. The con-

clusion is that the disease goes through a population and passes on after having reached only a small incidence.

The next most striking fact is its limitation of age. I think this is of the utmost importance. Characteristically, we have vastly more cases in children than adults. That does not strike us as remarkable at first, but on further thought it is very remarkable. Here we have a disease which spreads all through a city like New York, or even a smaller city, and just picks out the children under 5 or 10—90 per cent of all cases will be in those age groups—and which skips all the intervening older people. With regard to the age distribution it is, I believe, a significant observation that in our large cities generally epidemics have been confined more exclusively to certain age groups than has been the case in rural epidemics. For example, we have had quite a large proportion of adults attacked in epidemics in Minnesota. In all our epidemics in large cities the disease has been confined much more sharply to the age group under 5. In many cities the entire population above 24 years of age, over 50 per cent, remains entirely immune and is not touched by any visible sign of infection, although necessarily they are intimately associated with the others.

I believe we probably have as careful and as accurate intensive studies of poliomyelitis as of any other common disease except typhoid fever. Although these intensive studies have shown considerable individual differences, we can arrive at certain conclusions. Taking up first this, What evidence do we find of contagion? In certain small intense epidemics in small communities we have found just the picture we would expect to find of a highly contagious disease. We find the spreading from case to case, and all the appearance of a contagion. But we consider those as exceptions rather than the rule. Generally speaking, it is true that from 75 to 90 per cent of the cases on the most careful and searching investigation can not be traced to any previous association with the infection, either direct or specifically indirect.

Add those cases in which there has been known specific direct contact with a previous paralyzed or contagious child and those in which there has been indirect contact with a contagious person, and pile on those in which we can not exclude contact, and it will give us about 20 per cent of all cases. The rest of them we can pretty definitely say have not been in contact with any previously recognized case, and usually not with any probable case of poliomyelitis. Considering the children in families affected, we have certain data on the incidence of infection among them. Taking into consideration only paralyzed cases, if we made that our criterion for clinical diagnosis, the statistics in Iowa show that 5½ per cent of children associated with known cases of poliomyelitis in the same

family subsequently developed a frank paralysis. The same statistics in Buffalo show that six-tenths of 1 per cent of the children exposed subsequently developed the disease. If we include in the Iowa statistics the cases of abortive attacks of the disease, as I said before, it doubles the percentage and makes it 11 per cent. If we now include those in whom poliomyelitis was suspected, the percentage is again doubled, making it 22 per cent. Those are high percentages. Ordinarily we get, as a rule, an exceedingly small incidence among those known to be exposed. I think this leads us to the certain, definite conclusion that if the disease is contagious at all a large proportion of the persons who become exposed to it must of necessity, for some reason or other, be immune, or at least resistant to the clinical effects of the infection. If we conceive of poliomyelitis as a direct-contact disease, we have to assume the immunity of a large proportion of the population. I believe we can not get away from this. If it is a purely human contagious disease, it must be spread very largely from sources other than any recognizable clinically sick person, because, looking at it from every angle, we can exclude contact in a large percentage of cases. We find numerous cases occurring on farms 10 or 12 miles from a village, where the child attacked has not been off the farm for a considerable time. The only way it could get the disease at all would be from some adult who had not been himself in known contact with the disease but had simply been in a town or city where the infection existed. That is a remarkable conception, but poliomyelitis is a remarkable disease. If the contagion is confined to human beings, and a large number of persons are immune, it must be spread largely by carriers who presumably are adults.

We have in this disease a seasonal prevalence which is entirely the reverse of that of most respiratory tract infections and is more like that of a digestive tract infection.

I do not think we have excluded the possibility that the infection may be carried from person to person by insects, but I think the more general principle of a spread by carriers would seem to hold.

There is another possibility, purely hypothetical, and that is that poliomyelitis may be a disease of the lower animals, spread from them to man, either directly through contact, through secretions, or by insects. It hardly seems possible that we should reasonably suspect any lower animals except dogs and cats, which move over wide areas. The rapid dissemination within a few weeks from such a focus as we have in New York to the several States is rather hard to hitch up primarily with the spread by insects. If they are responsible, we would not expect the disease to spread so fast. Its rapid dissemination is apparently accounted for only by the rapid travel of

human beings. Also, thus far we have been absolutely unable to prove that domestic animals are even suceptible to the infection.

If poliomyelitis is a disease of animals, it must be largely a nonparalytic disease, because for many years epidemics have been absolutely and entirely without evidence of paralyzed animals; so that this connection with animals is at present hypothetical. Probably we must say frankly that we do not know how the disease is transmitted, but that the evidence points to the human being as the sole agent and to contact with nonparalyzed cases and carriers as the most important source of infection.

Dr. DIXON. Some of the French experiments show that there may be some connection with the spread of the disease by rats and mice.

Dr. FROST. Quite serious study has been given to rats and mice. It hardly seems to fit in with the epidemiology of the disease.

Dr. DIXON. No; but I wondered whether you had made any study of it.

Dr. FROST. No, sir.

Dr. DIXON. The French say that they have, and they have found some connection.

Dr. FROST. I was under the impression that they said that they had not.

Dr. DIXON. That was the last information I had. We are just trying that out.

Dr. WOODWARD. I should like to ask Dr. Frost a question concerning the epidemiology as to animals in the animal house connected with a laboratory. It seems that, if this disease is as rapidly spread as it is alleged by some, an inoculated monkey in an animal house, which had developed the disease, ought to be a source of acute danger to other monkeys, and also to the attendants. The results, of course, will show with respect to the other monkeys, because they are demonstrated later, some of them at least, to be nonimmune. They are used for experimental purposes. I would like to know whether there are any definite and specific precautions taken in the ordinary animal house to prevent the spread of the disease by natural processes from the infected monkey to noninfected monkeys and from the monkey to the rabbit, which also seems to be a possible reservoir of the disease, or to the attendants, and whether there is any evidence of the carriage by the attendants to their families of the contagion to other persons? Do they become carriers?

Dr. FROST. No, sir; there is no evidence of spread in this manner, and monkeys have been associated by scores with infected animals without taking the disease. Of course, in all laboratories where there appears to be danger of persons carrying the infection to their homes, rabbits and guinea pigs have been isolated. In one or two

instances guinea pigs isolated with monkeys have developed suspicious paralysis that was not definitely ascertained to be poliomyelitis.

Dr. STILES. Mr. Chairman, without having seen an active case of poliomyelitis, I am, of course, an expert on the subject. I should like to throw out a thought for consideration. It does not seem to have been touched upon as yet. Have we not in poliomyelitis a disease which is in the making? There are certain strong arguments in favor of this view. Have we possibly in poliomyelitis a disease which is due to some bacterial or other parasite of an insect which is absolutely nonpathogenic for that insect, but which when transmitted to the human being becomes pathogenic? We have cases of this kind. There are some among us who believe rather strongly that there are parasites of insects which are absolutely or relatively nonpathogenic to the insect, but which may be transmitted to man under certain conditions and become pathogenic. For instance, malaria, in all probability, is an acquired disease in man. The biology of the parasite seems to indicate rather strongly that the malaria organism was originally of the coccidial group and nonpathogenic to insects, and that upon being transmitted to man it became pathogenic.

Kala-azar is another disease of the same general category, a disease due to protozoan parasite that is apparently nonpathogenic to insects. Transmitted to man, it changes its habits and becomes a pathogenic parasite.

Everybody is guessing at the present time, and I thought possibly I might be entitled to a guess. I simply throw this out as a suggestion which has not been made by anyone else thus far, and which may possibly give a new lead in the line of thought.

Dr. WOLFF. The real object for which I contend this conference was called is to ascertain, if possible, whether the gentlemen who have made intimate studies of poliomyelitis have determined what the stage of incubation of the disease is. That becomes an extremely practical point for the health boards who manage the disease, because it determines just how far you should extend your quarantine or how far you should extend the separation of those who have been exposed to or in contact with the disease. For example, as a point in this regard, in the city of Hartford, Conn., on July 10, a case was reported which died on the 13th day of the month, and on July 21 a second case occurred in this family. Now, this second case had had no contact with any other case except this particular one that had died 10 days before, which rather gives the stage of incubation in that case as about 11 days.

On August 4 a person who had been playing with this second case and had had no contact with any other case of poliomyelitis

was attacked and on August 12 two cases, one of which was fatal, occurred in a house right next door; this gives us an incubation stage, also, of about eight days. From these three cases 78 other cases can be traced, and the average period of incubation was between 8 and 11 days.

My object in speaking of this is to open that part of the epidemiological discussion which would be of eminent service to health officers.

The CHAIRMAN. Does any gentleman desire to make further remarks on this subject?

Dr. TUTTLE. I forgot to make a motion, or rather a request, that the remarks of Dr. Draper and of Dr. Frost on symptomatology and epidemiology be published as soon as possible in pamphlet form and furnished to the various State health officers, in order that they may be of service to physicians. Last year the Public Health Service published a little pamphlet on the diagnosis of spotted fever, and I have had many calls for that pamphlet. This year Dr. Lloyd gave us a small pamphlet on the diagnosis of smallpox. I know that the health officials of Washington will thank you as I thank Dr. Frost and Dr. Draper for what they have given us. I hope we may have reprints made at an early date.

The CHAIRMAN. We will be very glad to bear that in mind. Is there anything further?

Dr. J. P. LEAKE. There is a point that might not be within the knowledge of all, and that is the extreme variability of the incubation period. We know only very little as to the definiteness of the beginning of incubation. In many cases there is, of course, experimental evidence, and in animals the disease is almost akin to rabies in the great variability of the incubation period. We have, in two cases reported in California last year, as long as 52 and 56 days, respectively.

The CHAIRMAN. Gentlemen, this question is open for free discussion.

Dr. PORTER. Mr. Chairman, the State and municipal health officers of this country are intimately connected with the public, and the public will want to know what this conference has concluded and what it has decided upon regarding this disease. It seems to me that it is important that some brief, yet concise statement, should be made, so that it can be given to the public. Therefore I make a motion that the chair appoint a committee consisting of these gentlemen who have given us such interesting epidemiological talks on this subject, to put in a concise and brief statement what is known at present as to the cause of this disease, its mode of spread, and the general symptomatology.

Dr. CARR. I second the motion.

The SECRETARY. I will say for the benefit of the conference that, while I do not oppose this motion at all, the service has already gotten out certain publications on this subject. One is the recent bulletin of Dr. Frost on poliomyelitis, what is known of its methods and modes of transmission. Another is a little story that was written in what we call a health news, which has been distributed very widely over this country. It seems to me it just might be possible that there is no need of duplicating what has already been done; but at any rate, those things would form a basis of the committee's work.

Dr. PORTER. My idea, Mr. Chairman, was that this committee should not only consider all the publications of the Public Health Service, which has done such excellent work, but also should have the advantage of the experience of members of the conference in civilian life who have had peculiar advantages in this respect in the recent epidemic in New York City.

Dr. FRANTZ. The first thing I shall be asked by two or three or four or half a dozen railroad, steamboat, and trolley men, when I reach home, will be, "What have you done at Washington?" They will be the first people who will ask me. Why? Because they are financially interested. Our transportation companies are losing money every day. If we are committing a wrong in quarantining, and requiring more than is necessary, we should change our requirements. But be that as it may, we will have to go home with some report as to what we should do with our railway and steamboat traffic, etc., and whether we will make any change in the rules and regulations which we have already established. Now, if we can secure some report of that character I think it will be better than any scientific document, because we can not take that home. The railway men here are waiting for something more positive in that line.

Dr. COLLINS. I agree with Dr. Porter, of Florida, and I consider that a brief, concise statement as to what we have done here on this occasion will be a relief to the people in our State. The railroad companies are constantly appealing to me, and it is a practical proposition. As to the scientific side of it, I believe from what I have heard here that we are still in doubt, and that we do not know just where we stand. However, we can agree, and we ought to agree, so as to be able to go home and deal with our utility organizations, railways, steamboats, and trolley lines. I am replying to inquiries all of the time. I have friends in New York, and they want to know whether they can come home or not, and all that sort of thing. I want a statement such as the doctor suggested, drawn by a committee appointed by the conference and adopted or rejected as we may see fit. As Dr. Frantz says, he has got to answer to his people, and I know I have to mine; a report written, and adopted by this

conference, which can be placed before the great masses of the people with whom we have to deal, is what we should have, and I feel like insisting on the doctor's motion.

Dr. SWARTS. This statement will rest very materially on the reports of the various committees.

Dr. COLLINS. I think this committee ought to report along with the committees which have been appointed. If I understand the proposition, they are really inseparable, and a broad document consisting of the three reports might be the very thing we desire. I think we ought to have something to carry home to our people. I believe a correlation of the three reports would be very appropriate.

Dr. OPPENHEIMER. I think the consensus of opinion seems to be that an indiscriminate quarantine will not be carried into effect. I consider that is the great danger we all run, that a general quarantine will be put into effect, and not only result in an individual paralysis but a general paralysis of traffic.

Dr. KING. I think that the intention of the motion was to formulate some statement that might be given to the press. They are now, I know, clamoring for statements to send out, and I understand that the idea in the motion suggested is to produce something that may be sent out to allay the fears of the laity in general. If that is the idea of the motion of Dr. Porter, I think it should be carried out, irrespective of the other, and that this conference should adopt these means set forth by the Public Health Service. I understand that is the object of the motion.

Dr. YOUNG. The thing I am the most anxious to carry home is the report of this committee on the prevention of the interstate spread of the disease. Four or five years ago we planned a circular on poliomyelitis. Lately I have been rewriting and preparing an eight-page pamphlet, and before I came here to this conference I had the idea of putting it in the hands of the printer and rushing it off; but I concluded to wait until I returned. A good many questions have come up as to the form of the certificate to be used. This matter of the settling of the form of the certificate I should like to have decided as soon as possible, and so I should like to inquire when we can probably have the report of that committee—when will they complete their work?

Dr. DRAKE. Mr. Chairman, as I understand it, the most important part of the entire conference is just before us, on the method of the control of the disease, and until that has been intelligently discussed and a committee appointed possibly to formulate minimum requirements, I do not think that there is much we can say at this particular time.

Dr. WOODWARD. If I understand the purpose of Dr. Porter's motion, it is that we prepare a brief circular on how to avoid infantile

paralysis. Now, if we can agree on a brief circular of that sort, by all means let us do it; but until we can, I am afraid we are going to fail to satisfy the public and we are going to display, not what we know about infantile paralysis but rather the great blank page of what we do not know. This body can hardly at present agree on any statement of accepted scientific facts concerning infantile paralysis that will be of great use to the public.

What the public wants, as I understand it, and what this body wants, and what the railroad men want, is some rule of conduct based on the best knowledge we have. It will certainly be the function of this committee on interstate and intrastate prevention to present such rules, as far as they can be laid down. It seems to me if we have one committee at work along the lines of practical administration and another committee undertaking to sift from the vast mass of undigested data material which they can approve, we will have trouble possibly in reconciling the practical application of the facts recommended by one committee with the facts that another committee asks us to indorse. I am heartily of the opinion that the whole matter of advice to the public had better be left to the committee on interstate and intrastate quarantine. When we have adopted their report we can then appoint a committee to prepare some scientific leaflet.

Dr. PARLETT. It would seem, speaking from a railroad standpoint, that something should be adopted, because the railroads are affected by virtue of their function as common carriers. In some States no certificates are required; in other States certificates are required to be carried by both adults and children; in still other States, where the conductor finds that children have not certificates, they are put off the train. I have a telegram this morning stating that four children were put off a train at Washington, Pa.—put off in the woods. Naturally the public will object, and the railroad companies object; and if there is anything we can do at this meeting, so that the railroad men representing the various railroads here may take back to their managements something that will help them as well as the public, I think it ought to be done. The railroads are perfectly willing to help. I think we have given ample demonstration of that, and we want to continue to render assistance. But we do not know whether to put up this notice here or that notice there, or not to issue tickets to children who do not have certificates, or if they present certificates whether or not they should be recognized as bona fide certificates. If we can have the seal of the State stamped on the various certificates when they are presented, so that they can be identified and stamped by the ticket agent and later taken up by the conductor, we will know what to do.

Dr. GARRISON. I move, as a substitute for Dr. Porter's motion, that his motion be laid on the table until we have a report from the interstate committee.

(The motion was seconded.)

The CHAIRMAN. You have heard the motion, that the motion of Dr. Porter be laid temporarily on the table.

Dr. PORTER. I am perfectly willing, Mr. Chairman, to withdraw it. I simply wanted to be able when I leave here to go down to Florida and when they ask me, "What did they do up at the conference," I will not have to say, "I do not know what they did. They did not seem to come to any conclusion as to what causes this disease or how it is spread or anything about it." I want to be able to say something, and to say it intelligently; and I am perfectly willing to withdraw my motion in favor of anybody else's.

The CHAIRMAN. I hope Dr. Porter will renew his motion later.

Dr. MCLAUGHLIN. Mr. Chairman, we are not getting anywhere, and we are wasting a lot of valuable time. We can not do anything until we get the report of that committee. We can not prepare a statement for the railroads or anybody else until we obtain the report of that committee and put the stamp of this conference upon it, and then we can give out a statement.

Dr. WOODWARD. I think there is one thing we can do before we get the report of the committee which will help very much, and that is to discuss this next topic, "General principles of control." If the committee can go into session with some knowledge of our suggestions it will be an advantage to them. I move we have that discussion.

(The motion was seconded.)

The CHAIRMAN. Without objection, we will so proceed. I would like very much to have Dr. Haven Emerson open this discussion.

GENERAL PRINCIPLES OF CONTROL.

Dr. EMERSON. I think I have really nothing to say on this. The only methods of control that the New York City department of health has attempted to put into force were the immediate reporting, prompt diagnosis, and removal of cases to the hospital. We discussed the matter with the best available talent in the vicinity of New York, and all of the officials agreed that until we had tried isolation of those affected, and had obtained reports of all possible cases and verified the diagnoses by competent diagnosticians, no other measures could be attempted or would be likely to prove effective. We judged that if our experience with other diseases was worth anything, 90 per cent of the trouble was going to come from the persons who were or had been sick. It may be that this disease is going to

be contrary to all other infections. It was our idea to get all the patients under fly screens, so that they would not prove centers of infection.

We adopted various measures also which seemed appropriate to our locality, limiting the movement of the children. We attempted to interfere with the congregating of children at moving-picture theaters, large picnics and excursions, and so on, and we have headed off a good many such mass groups of children. That prohibition still continues. Whether it has accomplished anything there is no possible way of telling. We realized that this procedure was not entirely beneficial, and we have had the mortification of going through our streets and finding the windows of tenements shut in the summer season lest this terrible "miasm" come into the houses and seize the children. We have had this warning produce the housing of children in wholly unsuitable places for fear of physical contact, and in spite of all this we have had the lowest infant mortality this summer in the history of the city. [Laughter.] The only thing we tried to do was to hospitalize the cases as soon as discovered, or to put them under conditions as near the equivalent of hospitalization as possible, and to avoid all unnecessary crowding and grouping of children.

You will see we have not endeavored to keep them off trolley cars or off the streets, but instead of setting aside play streets for the special gathering of children, away from traffic, we have tried to encourage their playing in their own premises, and not to mix unnecessarily with children from other places. We have kept as many of the camps open about the city as could be subject to ordinary observation. In other words, we encouraged the gathering of children whom we knew came from noninfected premises, provided medical supervision could be enforced. I do not think our control has been based on any other lines. We took advantage of this epidemic to obtain a more general and effectual enforcement of the reasonable requirements of the city with regard to the removal and covering of garbage cans, and the cleaning up of dirty places, but we did not do that with the idea that it would have anything to do with stopping the spread of the epidemic. We did it with the idea of taking advantage at this time of public susceptibility and we considered that the time was favorable to hit hard and try to get the people to obey the law.

The SECRETARY. Gentlemen, if I may I desire to speak on this subject just for a moment, for the purpose of summing up and attempting to crystallize the methods of control brought out to-day. It would seem to me that we can put this thing in a relatively few words. The notification of all cases; the prompt diagnosis of all infections, particularly those of children; the isolation of contacts

and actual cases, including enforced hospitalization where possible; the control of acute and chronic carriers wherever they are known to exist; the prevention of susceptible persons coming in contact with large numbers of other persons, including gatherings at theaters, churches, and schools, are all essential.

We must admit that if the schools are permitted to open under an accurate, active medical inspection, a great many children will be better off than if they are forced to stay at home. On the other hand, there may be, and doubtless are, children whose home conditions are so good that they can remain there without running the danger of coming into contact with children who are acute or chronic carriers of the disease. With regard to the playgrounds, it would appear to me that there is a good opportunity for the medical inspection of a large number of children.

Concerning the control of travel, it seems to me that the consensus of opinion expressed by the speakers is that travel is dangerous in so far as it permits the movement of acute or chronic carriers of the disease.

With regard to insects the evidence to-day is apparently against insect transmission.

It is extremely doubtful if food supplies play any great rôle in the spread of the disease.

Concerning the relation of sanitation to the disease, of course, we, as preachers of the gospel of sanitation, are always willing to take the opportunity to make conversions, but it seems to me as though the sanitary measures as applied to this particular disease are the use of a scatter gun or blunderbuss rather than the use of a rifle. [Applause.]

(Asst. Surg. Gen. Rucker here took the chair.)

Dr. BRACKEN. I am supposed to be in committee, but I want to say a word before I go. One thing I deem most important in the control of this disease is that physicians throughout the country recognize it. They do not always do this, and the disease is called all sorts of things. That is one matter which we must see to. First you have got to catch your hare and then skin it. If we recognize, or bring the doctors up to the point of recognizing, this disease, then these points which have been made by Dr. Emerson and Dr. Rucker come right in line, the matter of reporting and isolation. I am very glad indeed to have this point of hospitalization brought out. Fortunately we are not all of us situated as Dr. Emerson is in New York. Most of the children in Minnesota probably have 16 square miles to play in per child, yet isolation even for them is important. We have been handling our communicable diseases at home in quarantine all along, when they ought to be hospitalized. We ought to take the individual out of the home and leave the home free.

Dr. ALBERT. I should like to ask Dr. Emerson in regard to the isolation of cases, and also what is done to control the contact of the child with the family?

Dr. EMERSON. Every patient we have discovered and accepted as a true case has been isolated for eight weeks. We are beginning to discharge cases now. The quarantine period of eight weeks begins from the date of onset and not from the date the diagnosis is established. All children under 16 years of age in the families of or in contact with acute cases have been kept within their premises for two weeks. If the case is removed to the hospital, the other children of the household are kept at home two weeks; and if the case dies, they are kept at home two weeks. If, therefore, the patient is kept in the home for his eight weeks' quarantine, instead of being sent to the hospital, the other children of the family must stay two weeks more beyond the quarantine period of the acute case. That means 10 weeks. If parents choose to run the risk of keeping the child at home, they must abide by these principles, which we have carried out from the beginning. The incubation period is quite uncertain, and it is a guess as to the necessary period for quarantining. We have done what we thought was practical and not what we considered scientific.

Dr. HAYNE. I simply want to ask a question with regard to the spraying of the nose and throat, whether it has any prophylactic value. In cerebrospinal meningitis I do not close the school, provided the children before entering have their noses and throats sprayed with an antiseptic solution; we usually use Dobell's solution. I was under the impression that that was a good method until reading in some of the newspapers—and we have had a great many articles, inspired and otherwise, in regard to the control of this disease—in which it was stated that spraying not only was not beneficial, but that it actually did harm, because it injured the delicate mucous membrane of the nose and throat and probably thereby increased susceptibility. Now, of course, I know doctors are immune to all diseases and carry none of any description. Consequently when I visit houses where there is infantile paralysis, and I have had to visit 25 or 30 within the last week, I in my ignorance used to spray my nose and throat, with the idea that possibly I might not carry the infection to my children or to other persons. I should like to obtain the consensus of opinion whether that does any good or whether it is just a useless method of annoying one's self?

Dr. EMERSON. I can not give you the consensus of opinion on this matter, but I can tell you the consensus of opinion of the city specialists and others to whom the question was referred for an opinion at the beginning of this epidemic. Physicians generally used an atomizer with a normal salt solution. Practitioners in the city in

general are against the popularizing of the use of the nasal spray among children.

As a matter of fact, as to carrying infection, the president of the medical board of one of our hospitals lost one child and another child was infected, and it seemed as if he might have carried the disease home to his family. I think that will bear a little statement in explanation. The practice of the doctor was to change his clothes and get into a suit of duck when he reached the hospital and to wear his gown and cap. He washed his hands and face before he left, and when he returned home he changed into other clothes. He never took his children in his arms or kissed them or had them about him, and he had a separate entrance to his office, an office apartment. A further important fact is that the nurse of those children, a Polish woman, left after she had put the children to bed and went and spent the night at the home of her sister, whose child was infected, returning the next morning to the doctor's children. She, with her habits, coming from an infected case, appeared to us and to the doctor who lost the child as the more probable carrier.

I think every doctor always takes the precaution not to get into the spray line of a patient, and that the habits of doctors become so self-protective that they are least likely to carry infection. Physicians do not go into houses where there are healthy children looking for a case; they go when they are summoned to a sick patient. We have not found that the infection could be traced in any way to the doctors and nurses in attendance at hospitals. You must remember that these patients have been admitted to general hospital wards, and no single case has ever developed under hospital conditions. Now, why is it?

Dr. McKelvey. I presume Dr. Emerson is tired of answering questions, but I should like to ask him to what extent fumigation is used in New York and to what extent it has been used in this disease?

Dr. Emerson. It was abandoned throughout the city two years ago for all diseases. We do not use it. [Applause.]

Dr. Swarts. Do you mean disinfection or fumigation?

Dr. Emerson. I mean disinfection by fumigation.

Dr. Swarts. In connection with this disinfection by the use of a spray and the application of Dobell's and other solutions, I think it is a good idea not to recommend it to the public for general use, because they are likely to apply too strong a solution and injure the cells of the mucous membrane, which are a protection, in a measure, against organisms of every kind. Furthermore, I should like to know whether the opinion is correct that the removal of tonsils and adenoids causes a predilection to this disease?

Dr. EMERSON. The consensus of opinion is that no operations for removal of tonsils or adenoids should be done when the disease is prevalent, lest it make the patients more susceptible to infection of every kind.

Dr. YOUNG. The question now arises as to individual hygiene. I believe great good could be accomplished if a committee were appointed to formulate rules and regulations, or an outline of the hygiene of the individual in his relation to poliomyelitis; not only for the individual physician, but for the individual himself.

Dr. MCKELVEY. When I asked the question awhile ago as to disinfection I was fully aware that New York had abandoned what is ordinarily known as terminal disinfection, but recently I have seen something in the press regarding fumigation or disinfection which led me to believe that possibly some exception was made in the case of this disease. But we have in the rural sections of the country certain conditions that are not existing in New York City in regard to disinfection. In New York City they have the means and the men to go to the houses and carry out certain rules and regulations as a substitute for disinfection employed throughout the country more generally. In the rural districts you can not do that. It seems to me that it would be proper for us to have an understanding as to how disinfection should be employed. That is what I wanted to bring before the conference. What are we supposed to do in the rural districts? We can not in all instances have a health officer to superintend the repapering and repainting of the walls of the building and of the floors. There should be some general plan worked out.

The CHAIRMAN. It seems to me, Dr. McKelvey, you could trust to the layman in painting and papering and calcimining better than you could to the action of a gaseous fumigating agent; the fact is that soap and water and a good strong elbow kill more germs than formaldehyde ever thought of killing.

Dr. WOODWARD. I should like to ask those familiar with the epidemiology of the disease whether there are any instances of school outbreaks. It might throw some light on the subject whether history records institutional outbreaks. Dr. Emerson has referred to New York, where great care is taken to prevent their occurrence. My recollection is that in New England there was an instance where without the exercise of any precautions the institutional population largely escaped. My question was whether there have been school outbreaks of any kind, and I think it is very pertinent to the present situation at the present time of year.

Dr. FROST. Answering Dr. Woodward's question, there are records of outbreaks apparently connected with schools. I have in mind some Swedish outbreaks that Wickman reports. He considered that the schools were sometimes the foci of infection. I can personally

report one outbreak which seemed to very definitely originate and be spread from a small country school. I have seen at least one outbreak in a large city, where the schools were open, and where there was no evidence of their acting as disseminators of the disease. I think in one school in the kindergarten grade we had two cases. In other schools we had only isolated cases among the pupils.

In regard to institutional outbreaks I do not recall anything definite regarding their occurrence. I think it has been generally the fact that institutions have been rather free. That is my impression. I have occasionally seen one or two cases in large institutions, but not constituting an outbreak of any proportions.

Dr. STILES. At the present moment it is not a question of closing but of opening the schools. Take our Washington schools; the pupils are scattered from Maine to Florida, and as far west as California. They will open here late in September, I have forgotten the exact date, but about the 25th of September.

The CHAIRMAN. It is the 18th.

Dr. STILES. Is it wise, under present conditions, to have the Washington children return to the schools and mingle with other children, who have been away all over the country, or is it wise to bring those children back to Washington and to open the schools as early as the 25th of September? I should like to emphasize the point that it is not a question of closing the schools at the present moment but of having children all over the country travel from infected districts back to their homes, in many places to uninfected cities, to enter the schools. It looks to me as if that were one of the critical points to be discussed of the present situation.

Dr. FRANTZ. Mr. Chairman, I should like to say, relative to the schools of Delaware, that any child coming from an infected district, or who has been in contact with infantile paralysis infection, will be taken care of in the State of Delaware, and will not be allowed to go to school for two weeks after he returns. Unless we should have an epidemic, or more cases than we have had in Delaware, we will open our schools the second Monday of September. That is a question which each State must solve and settle for itself. But I think that with the report which we hope to get, through the deliberations of this organization, we can take care of all these children.

Dr. YOUNG. As to the bearing of opening the schools upon the economic question. Just before I started to come on here I was called to make a rapid run of 16 miles to a large summer hotel on account of two or three cases of typhoid fever among the help. The manager of the hotel told me that many of his guests would remain there much longer than usual. They had declared that they would not return to New York City or other places where there might be poliomyelitis, until November. I have heard similar re-

ports from the managers of other hotels along the coast and in the interior of Maine. That is just a point on the economic question.

Dr. CARR. Mr. Chairman, in Nebraska we will open our schools about the 11th of September. We believe that where there is good school inspection and the children are healthy, we are better able to keep in touch and to cope with disease of any type. Hence our schools will commence in Nebraska on time.

Dr. MCLAUGHLIN. I would like to ask Dr. Emerson a question, but I have not the heart to do so. I think it is really unpardonable the way we have imposed upon Dr. Emerson, and I want to say, in my opinion, how fortunate the city of New York, the country at large, and this conference in particular, are that the health commissioner of New York is a gentleman and a scientist. [Applause.]

Dr. Haven Emerson as a scientist does not lose sight of the opportunities of finding out just how this disease is transmitted, but has thrown open the scientific resources of his department, and has welcomed the scientific aid which may come from outside sources, and given to those outside his department every opportunity to come there and use what he has. As a gentleman, he has attempted no concealment whatsoever, and along the Atlantic seaboard I know we appreciate the frankness with which he has declared what he had and has shared with us all the information in regard to this baffling epidemic. [Applause.]

The CHAIRMAN. I am very sure that Dr. McLaughlin voices the sentiment not only of the Service in this conference, but of the Nation as a whole, and I wish not only to second very frankly everything Dr. Emerson has said, but to express our gratitude to him for coming to-day and giving of his very precious time to help us in this present emergency. [Applause.]

Dr. TRASK. I should like to add just one word to what has been said. In times of epidemic the natural tendency on the part of the community is not to see or recognize the presence of an outbreak. The natural tendency is to want to suppress facts, or not to let them become known. Many communities have, especially during the last decade, shown a tendency to overcome this natural inclination, and have firmly and positively warned other States, cities, and the Nation as a whole, and I believe sincerely it has resulted in their own benefit. But there has been no instance I know of where the tendency to absolute frankness has been so marked as in the present outbreak in New York City, and if it is the consensus of opinion of this conference I think it would be a most excellent plan to indorse in decided terms the stand in regard to publicity and frankness which has been displayed by the Department of Health of New York City. [Applause.]

Dr. PORTER. I second that motion.

The CHAIRMAN. It has been moved and seconded that this conference indorse the policy of publicity carried out by the department of health of Greater New York.

Dr. WOODWARD. I should like to move to amend that by saying that the Public Health Service shall send a copy of that, as prepared, to the mayor of New York and to the press of New York.

(The motion of Dr. Woodward was seconded, and the question being taken, the motion as amended was agreed to.)

The CHAIRMAN. Gentlemen, the hour is getting late, and we must decide what we will do with the remainder of the program. Is it the wish of the conference that we shall convene this evening for further deliberation or adjourn until to-morrow?

Dr. WOODWARD. Before we adjourn, I want to say I think it is important that we know when these committees will be likely to report.

The CHAIRMAN. It seems to me if the committees could do their work this evening it would be wise for the conference to adjourn until to-morrow morning. That would give the evening to the committees to work.

(At 5 o'clock p. m. the conference adjourned until Friday, August 18, 1916, at 9 o'clock a. m.)

MORNING SESSION, SECOND DAY.

(The conference was called to order at 9.30 o'clock a. m. by Asst. Surg. Gen. W. C. Rucker, acting chairman.)

The CHAIRMAN. The conference will please be in order. The first subject for consideration this morning is "The relation of the community to the aftercare of poliomyelitis patients." I think that in the discussion of this subject the conference would do well to consider not only the important points of the medical and surgical treatment but particularly the sanitary aftertreatment, and I will ask Dr. Albert, of Iowa, to open the discussion.

THE RELATION OF THE COMMUNITY TO THE AFTERCARE OF POLIOMYELITIS PATIENTS.

Dr. ALBERT. The seriousness of poliomyelitis is regarded as so great that many people feel they would prefer to have their children succumb to an attack of the disease rather than to be affected by the paralysis which often cripples them for life and makes them dependent, or very largely so, for the remainder of their days. The situation is, however, by no means so hopeless as it has seemed to be in the past, and a great deal can be done, as is now well demonstrated, in the way of preventing the deformities in the first place

and in curing them after they have developed. I presume the reason why the chairman asked me to open this discussion is because we have a place in Iowa where we undertake to overcome these difficulties to a large extent. Overcoming deformities in necessarily a long procedure and an expensive one. Heretofore only the well to do have been able to give their children the proper kind of care. The poor have usually neglected their children, and they have often become charges on the community.

The last legislature in Iowa made provision by statute for the sending of children to the University Hospital for treatment, including provision for free treatment and for payment of all expenses. Most of the children who have come under this law were either crippled or deformed, and a large portion of them are children who were deformed during the epidemic of poliomyelitis which occurred in our State in 1910. At that time we had several hundred cases. During the past year some 80 children have received treatment, and it is remarkable what results have been obtained. I am sure that when our administrative authorities go to the legislature the coming session for an increased appropriation for this service, there will be no difficulty in obtaining it. The results have been very remarkable and satisfactory, and universally praised. Nevertheless, the results obtained have been in the nature of correcting deformities, while the object should be to prevent these deformities as far as possible. It is quite certain that as an outcome of the present epidemic we will have a large number of early cases sent to the University Hospital, with the idea of preventing deformities. I may say that it has been our experience, and I presume it has elsewhere, that physicians in general do not pay sufficient attention to the questions of massage and other procedures in the way of properly reestablishing circulation, with the idea of having the muscles regain their functions.

I think that the attention of physicians ought to be called to the fact that a great deal can be done to prevent the serious deformities which often follow attacks of poliomyelitis.

This is a thing which it seems to me has been very largely solved in our State, and it has been done, of course, by many municipalities also. From the standpoint of the State, the best solution of the problem is to make provision for these children, to have them treated in a State institution at State expense, and not only to treat cases such as we have been treating during the past year, but also the rather early cases, after the patients have recovered from the acute disease.

Dr. RANKIN. What has it cost in Iowa, per capita, or case, to do this?

Dr. ALBERT. I am not able to tell you. No figures have been available as yet. We have been operating only nine months.

Dr. WOLFF. How much of an appropriation have you?

Dr. ALBERT. It is rather a peculiarly worded law. The law says that the patient shall be sent to the University Hospital and that the county shall pay the transportation charges. An examination by a physician is provided, for which the physician receives $5. All other expenses are borne by the State. The medical expense is borne by the university. In this way the law serves a double purpose. It renders to the poor people of the State a service and also furnishes the university medical department with clinical material.

Dr. WOLFF. And what is the total appropriation?

Dr. ALBERT. I was getting back to that. For the medical and nursing service no charge is made. It is presumed that the hospital physicians will render their service without charge. Now, the question of the so-called hospital charge is referred back to the executive council. No appropriation is made, but whatever it costs to maintain the patient in the hospital, aside from the medical and nursing service—simply the hospital room, board, etc.—is charged to the executive council of the State, and so far no figures have been available. No appropriation of any kind is made.

The CHAIRMAN. Will some one else discuss this subject?

Dr. PORTER. I should like to say that in Florida several years ago the legislature passed a bill providing that the indigent crippled children of the State should be cared for at the expense of the State board of health. Until the number was found sufficient to warrant the construction of a hospital and provide a staff therefor, the State health officer was authorized to arrange for their care in any private or public institution. Since that time we have added to the staff of the executive force of the State board of health a surgeon of prominence and of expert knowledge in orthopedic treatment, and we have treated numbers of white children at St. Luke's Hospital and colored children at the Brewster Hospital. This treatment has been free of any charge where the patients were indigent, the only requirement being that they shall present themselves at these hospitals in Jacksonville. We hope at no distant future to be able to construct a building especially devised for this purpose. The bill under which the work is performed had its inception with Gov. Gilchrist, of Florida, who had a philanthropic desire to aid the crippled children of the State. There is quite a little history attached to it, which it is not necessary for me to go into right now; but there has been a vast amount of good work done. Those of the conference who receive the annual report of the State board of health of Florida will notice in the appendix a great many interesting photographs of cases at their inception and after subsequent treatment.

Dr. WOLFF. What is the cost per patient?

Dr. PORTER. Independent, I think, of the salary of the surgeon, we spend some $6,000 annually. That is for the hospital care of patients and the first braces. Subsequent braces are paid for by the parents, but their fitting to correct deformity is defrayed by the State. I do not know the exact amount, but those of you who have our report—and every health officer in the United States has one sent to him each year—can refer to the table, ascertain the details, and observe the photographs.

Dr. CARR. Mr. Chairman, Nebraska is very proud of the work she has done for crippled and deformed children, and as I reported here yesterday, is making great strides in this line of endeavor. A few years ago we obtained an appropriation, after a hard fight before our legislature, of $10,000. The next legislature gave us $100,000, and so it has been ever since; we have been able to get any amount that is needed and required for this special line of work. It is a line of work that is especially appealing, and legislators, when they go out to our orthopedic hospital, simply come back and say, "Why, you can have any amount, at once." It is surprising that we are not able to get over about $20,000 annually for health work in Nebraska, but for deformed children we can obtain any amount we ask for.

This work is not under the State board of health, by the way, but it is under the board of control of the State, and all patients, both indigent and rich, are served alike.

Dr. SWARTS. Mr. Chairman, it little behooves the health department, perhaps, to indicate to the physician what shall be the treatment, but in the absence of knowledge this practice is quite prevalent among officials. It seems proper that indigent children should be taken care of by those who have information which is of value, and for this reason the departments of health should state or suggest to the physicians who are not willing to obtain knowledge from other sources what has been found of advantage in these cases. Physicians are looking to us for this information, which we should endeavor to collect. We should know that there is a possibility of deriving some benefit, not alone to the individual patient but from an economic standpoint to the State, in the conservation of the power of such muscles and nerve filaments as may have been left only partly affected or intact and unused from lack of encouragement. Efforts along this line are commendable, and it is a pleasure to see that the Western States, which are so far ahead of the effete East, are alive to this fact. I trust that this conference, before it decides to close, will take some action on this matter, recommending that health departments secure from their legislatures as much assistance as they can get to place these cripples in a condition whereby they can care for themselves, because it is of distinct benefit to the State. I heartily indorse

the work which has been described in these Western States, and hope we may have some result from these efforts.

Dr. LADD. Dr. Emerson, of New York City, wanted me to make the following statement: They have decided in New York to follow the same general course we have adopted in Vermont, and they have already organized a permanent committee. As a patient is discharged from the hospital he is given a written statement of just the condition he is in at the time. They also give a list of orthopedic dispensaries of the city, so that the patient can be taken to the nearest one. It is the duty of the organized and permanent committee to follow up the work and see that the patient is taken to one of these institutions. Muscle training is also taken up at the home through the urging of this committee. The State is to be districted, so that the work may be systematized.

The CHAIRMAN. It seems to the chair that while the prevention of this disease is the function of the departments of health, we should not lose sight of the fact that if we fail to prevent it we will have these cripples. One of the most pitiful things with regard to poliomyelitis is the fact that thorough aftertreatment results in such slow progress, and from month to month very little improvement can be noted. The result is that the parents become discouraged. They cease to patronize a reputable physician, and they begin going around to quacks who advertise, "We cure paralysis." They go from quack to quack until a condition is arrived at where the family resources have been exhausted and the opportunities for cure of the patient have been entirely lost. I think that the movement which has been started in New York for the creation of a fund to provide treatment at a special hospital for these children is one of the greatest and most beneficent philanthropies that could come at the present time. Much as we, as health officers, want to prevent the disease, I still think we should not overlook the raft of human wreckage which follows in its train. [Applause.]

If there is no further discussion on this question, we will now receive the report of the committee on uniform methods of collecting statistics regarding poliomyelitis. Dr. Lavinder.

REPORT OF COMMITTEE ON UNIFORM METHODS OF COLLECTING STATISTICS.

Dr. LAVINDER. Gentlemen of the conference, the committee, in making its report, has two or three things to offer. The first is that there are representatives of a large number of States here, and they all came prepared to give us a certain amount of data. I do not know how great it is, but it is valuable to us, so that we have prepared a form for temporary use, to be distributed among the gentle-

men present, with the request that they offer their suggestions before they leave, and that they fill out this form giving us the information they have with them. Many of them have already made reports. Copies of this form will be distributed to everybody, and if you do not get one, please look for it and fill it out before you leave, so that we may have what data you possess.

In addition to that, there are certain other data wanted, and we have compiled two forms which will be completed shortly. One of these forms is an attempt to get poliomyelitis statistics from the States by months and by counties since 1910. That, I presume, will be mailed to you if the meeting approves of the form.

The other is a form for the collection of poliomyelitis statistics by periods, with the details concerning sex and color. We thought we could get those data, and it would be very important to us right now.

Finally, there is the form which was adopted in 1911 by the health authorities, copies of which I desire to distribute so that we can run over it quite rapidly. This is a case report which was gotten up in 1911 in order to standardize and make more uniform the data collected with reference to poliomyelitis in each State. Some slight changes which I will run over in a minute have been made by the committee. I wish to make it plain that this case report is for use in individual States where the health officer desires to make more detailed studies of particular cases. I do not believe that the Public Health Service has any method of receiving all reports and tabulating data. It would be a very large job which we at present have not the machinery to handle. This form is distributed with the idea that if the State wants to study the individual case, this is the form to be used, and then the data are all comparable on the same basis. We thought it better that the conference should run over this, so that any changes suggested could be made.

The second line indicates by check whether the case is paralyzed or abortive. The first page remains just as it is. I would like everybody to look that over and see if they have any suggestions to offer. Then we have the patient's name, age, and sex, nationality of father and mother, occupation of father and mother, residence, post office, and county. Does patient live in city, village or country? If in country, state distance from center of nearest town or village, Status of family; well to do, moderate, poor? Sewage disposal, flush closet, cesspool, privy? General sanitary conditions; excellent, good, fair, bad? Previous general health of patient; excellent, good, poor? Had patient suffered from any illness, indisposition, or accident within a month prior to this attack? Nature of illness or accident.

OTHER MEMBERS OF FAMILY (INCLUDING GUESTS, BOARDERS, AND SERVANTS).

Children: {Males (age of each)_____ Females (age of each)____ Adults: {Males, number_____ Females, number_____

Were there any other cases of sickness in the family within one month before or after this attack? _____

Give name, age, sex, date, and nature of each case?_____

_____

SYMPTOMS OF ACUTE STAGE.

Fever: High, moderate, slight, none?_____
Headache: Severe, moderate, slight, none?_____
Constipation, diarrhea, vomiting, sore throat?_____
Pain, distribution? _____
Tenderness, distribution? _____
Retraction of head, restlessness, drowsiness_____

That page stands as it is, with the exception that the second line is placed elsewhere.

On the next page the first line is inserted, "Type of case, abortive or paralyzed." We took that from the head of the first page and put it in this place on the second page.

Then that page continues:

Date of onset of acute symptoms_____
Date of onset of paralysis_____
Distribution of paralysis at its worst_____
What treatment was employed, and with what apparent results—
(*a*) In acute stage_____
(*b*) Subsequent to acute stage_____

Then there is added "With special reference to restoration of motion."

Then we have:

OUTCOME OF CASE TO DATE.

Recovery (complete disappearance of paralysis)_____
Improvement, extent of paralysis remaining_____
Death, date _____

CONTACT WITH PREVIOUS CASES.

Then there has been added "Date when previous case occurred."

Then, with two additions, it continues as follows:

Had patient been associated with any previous case? If so, state whether paralyzed or abortive; give name, address, and date_____
1. Had patient or member of family visited any place?_____
2. Had any visitor been to see family?_____
Did patient attend school?_____ Where?_____ Grade_____
What were the weather conditions immediately preceding this attack? Hot, mild, cold, wet, dry, dusty, unusual in any respect_____
Have any infective diseases, respiratory or digestive troubles, or unusual disorder of any kind been unusually prevalent in the community?_____

What animals or fowls were kept on the premises within month preceding attack?_____
Has there been any paralysis of animals or fowls in the vicinity?_____
What preventive measures were carried out?_____
Remarks: Please state any other facts of interest concerning the case_____
Date of filling out report_____

Signed_____, M. D.,
Address_____.

Dr. WOLFF. I should like to add to that "Was there any intimate contact with such animals on the part of the patient?"

Dr. LAVINDER. Has anybody anything further? You understand, in getting up this blank form, we wanted to make it as simple as possible, and we eliminated certain things. If you were to multiply the questions, you would not get any result at all. We felt that this was the maximum; the best we could do. There was no other change made, except that the address was added under the signature. Now it is suggested that we make a question as to whether there was contact with fowls or animals.

Dr. HOFFMAN. I would suggest that you indicate the race, and that you substitute the word "nativity" for "nationality."

Dr. LAVINDER. That was a subject of discussion with us, and we decided to omit it.

Dr. HOFFMAN. Why should you want to omit the race?

Dr. RANKIN. You would have to have the race in the South.

Dr. HOFFMAN. As to race, white or black.

Dr. LAVINDER. Yes. We discussed that question, and we felt we would not be justified in inserting it.

Dr. HOFFMAN. The statement was made by Dr. Emerson that it was thought for a while that among the negroes in New York City they had no cases at all. That was not correct. It would have been of very great consequence if it had been true.

Dr. LAVINDER. You could put it "white or colored."

Dr. YOUNG. Were you here yesterday afternoon?

Dr. HOFFMAN. Yes. I refer to the first discussion in which the statement was made by Dr. Emerson. If that statement had been subsequently found to be correct, it would have been of great value.

Dr. TRASK. The trouble with the word "race" is that it is understood differently. Many think of the Malay and the Caucasian and the Mongolian when you use the word "race." Then, of course, some understand it as meaning nationality. If that information is desired, that is the best way to put it.

The CHAIRMAN. Let Dr. Lavinder finish his report, and when we come to the question of its adoption we can have the discussion.

Dr. LAVINDER. Dr. Drake suggested, and it seems to me it is not a bad idea, that we number each one of the questions on this blank, and

then we can attach an explanation as to what we desire by referring to the number of the question.

I should like to add a word or so that has no connection with the specific matter now under consideration, but which is more or less of an appeal to you personally. There are certain cases which leave infected centers, particularly in New York City, and go to other parts of the country, certain selected cases, in which the chronology is of enormous importance for the purpose of attempting to establish more or less definitely an incubation period. Yesterday Dr. Frantz, of Delaware, reported an instance of that kind. They are not all of value, but some of them are, and we in New York would be very glad to receive from anybody a detailed report of such cases, especial attention being given to exact chronology of events. We feel that those cases are of special importance with regard to establishing an incubation period, and if any of you have the information we would be very glad to get it. Finally it was suggested that this conference might appoint a standing committee on statistics with regard to either poliomyelitis or other diseases, so as to make them uniform.

That completes the report of the committee, with the exception of the discussion.

The CHAIRMAN. You have received the report of the committee. What is the wish of the conference? The chair will entertain a motion that the report of the committee be received.

(It was moved and seconded that the report of the committee as read be received.)

Dr. ROBERG. Mr. Chairman, if this report is adopted, I would like to suggest that in addition to this, on the reverse side, at the close of the blank, the differential diagnosis of infantile paralysis from other diseases in which there are meningeal symptoms be printed, with the view of helping in the filling out of these blanks. There are many diseases with symptoms which are with difficulty differentiated from poliomyelitis. I had a case of central pneumonia in which the examination did not indicate the lung symptoms, but the entire picture was typical of poliomyelitis. Two days later the lung symptoms could be identified as pneumonic. Now, a differential diagnosis or mention of those diseases which have meningeal symptoms, if placed in fine print in this report, would help many physicians in filling out these cards.

Dr. BLACK. I second the motion that before this be received it be adopted section by section.

The CHAIRMAN. With regard to what Dr. Roberg has just said, the chair would suggest that it would be better to attach to this blank a little pamphlet for the benefit of physicians bearing on the salient points in the diagnosis of the disease. I think that would serve a better purpose than to put it in the corner of the report in fine print.

Dr. KING. On the first page of this blank, under "Acute stage," there are two suggestions I should like to make. One of the questions discussed in this country and one of the things we have been led to believe with reference to poliomyelitis is that the secretions from the nose and throat carry the virus of the disease. Yet I find nothing under the true symptoms of the disease to indicate whether or not there has been, prior to the attack, during the attack, or subsequent thereto, any unusual nasal or throat discharge. In our study of poliomyelitis in Indiana, covering four or five years of more or less superficial investigation, the blank form which went out to the physicians requested information as to this predominant symptom. In more than 84 per cent of the cases studied personally there was a profuse perspiration, which could not be accounted for except as one of the rather prominent symptoms of the disease under consideration. I do not know that this has been true in the experience of others, but it was true in the Indiana cases. It occurs to me that under the head of "Acute symptoms" it might be well to have the data regarding this particular symptom. The two questions I would like to have you add are with reference to profuse perspiration, and whether nasal and throat discharges be present.

Dr. LAVINDER. I suggest that we take the first section and find out whether there are any changes to be made, and we will get along much faster.

The CHAIRMAN. I think that is a very good suggestion, and we will consider this section by section. Has anyone any suggestions to make regarding the first section; that is, down to "Other members of family (including guests, boarders, and servants)"?

Dr. LAVINDER. The second line is eliminated and placed in another place. There is "Patient's name, age, and sex. Nationality of father and mother." Now, it has been suggested that we add a suggestion there on color.

Dr. BLACK. I move that we put in there, "white or black."

Dr. DRAKE. If we are to incorporate that question as to race, I think it would be very much better to indicate it as it is indicated on the standard blank; that is, red, white, black, or Indian. That covers all the races.

Dr. SWARTS. Is it desired to discover the color of the skin of the patient, or the place he comes from? It seems to me it is the question of nationality that the collaborators want to get at, to determine the susceptibility of Germans, Irish, or Americans. It is not a question of whether the skin has a light color or more or less color. It is rather a question of nationality.

Dr. TRASK. It seems to me from what has been said that there are certain communities in special sections of the country having what is known as a colored population, and that in those sections the words

"white" and "colored" would be thoroughly understood, and will bring out the desired information; that under other circumstances the word "nationality" would perhaps come nearer giving you the information you desire, whether Italian, German, or Scotch. I would suggest in addition to the form as it stands that there be inserted "white or black," or "white or colored," in the line under nationality.

The CHAIRMAN. Without objection, the words "white or colored" will be inserted in this section.

Dr. BURKART. I move the adoption of the suggestion of Dr. Trask.

The CHAIRMAN. Without objection, it will be inserted.

Dr. HOFFMAN. I believe that the word "nationality" is wrong, politically and scientifically, and that the word "nativity" should be used. There is no use in carrying forward in a new plan of the Public Health Service an obsolete, senseless term. If a man is reported as an American citizen, his nationality is that of an American. If you take his nativity he may be by nativity a Frenchman, German, or Italian.

Dr. TRASK. Any way you do it you are going to get into trouble. It is not a question of the way you would like to do it, but the answers you are going to receive. I think if you say "nationality" the average person will say "German" if the patient is a German residing in the United States and an American citizen; on the other hand, if you say "nativity," you are going to get the place of birth. The person may be of a distinctly Teutonic family, or may be of Semitic origin, and still be born in Portugal. I think it is the lesser of two evils, and it will be for you gentlemen from your experience to answer these questions in the way that will give the more exact information.

I can not agree entirely with Dr. Hoffman. My impression is that you will get better information with the caption standing "nationality" than with it standing "nativity," and derive more nearly the information you want.

Dr. WOODWARD. Would not the word "birthplace" obtain the information you desire?

Dr. TRASK. That is the same as "nativity."

Dr. WOODWARD. That is understood, and that is all you want.

Dr. TRASK. The point is not to determine where a man was born, but whether he is a Teuton or a Scandinavian or a Greek or an Italian. That is the information you want.

Dr. WOODWARD. It seems to me, Mr. Chairman, you are going rather finely into the tissue functions of individuals when you try to ascertain whether the parent of this 5-year-old child was born in America. It hardly seems we are going to get anywhere on a trail

of that sort. The important thing is, practically, whether he is foreign in his instincts, foreign in his habits and in his mode of life.

The CHAIRMAN. That is the point.

Dr. WOODWARD. It is really the social status of the man we are interested in, rather than where he was born, because we want to determine whether the disease prevails throughout certain social groups.

The CHAIRMAN. What is the pleasure of the conference? Shall this word be "nationality" or shall it be "nativity"?

Dr. WOLFF. I move it remain as it is.

Dr. BURKART. I second the motion.

The CHAIRMAN. It has been moved and seconded that the word remain as it is. Without objection it is so ordered, and it will so remain.

Are there any further suggestions regarding this first section? If not, it will be considered adopted as read.

Will you proceed with the second section?

Dr. LAVINDER. "Other members of the family, including boarders, family, and servants."

Dr. BURKART. I move its adoption as read.

Dr. SWARTS. I second the motion.

The CHAIRMAN. Is there any discussion? Without objection it will be so ordered.

Dr. LAVINDER. The next section reads:

SYMPTOMS OF ACUTE STAGE.

Fever: High, moderate, slight, none_____
Headache: Severe, moderate, slight, none_____
Constipation, diarrhea, vomiting, sore throat_____
Pain, distribution_____
Tenderness, distribution_____
Retraction of head, restlessness, drowsiness_____
Pain on anterior flexion of spine_____
Type of case, abortive or paralyzed_____
Date of onset of acute symptoms_____
Date of onset of paralysis_____
Distribution of paralysis at its worst_____
What treatment was employed and with what apparent results—
(*a*) In acute stage_____
(*b*) Subsequent to acute stage, with special reference to restoration of motion_____
What preventive measures were carried out?_____

The CHAIRMAN. What is the pleasure of the conference with regard to this section?

Dr. SWARTS. How about the nasal and throat discharges and unusual perspiration?

The CHAIRMAN. That was a point brought up by Dr. King, I believe. What is the opinion of the conference?

Dr. LAVINDER. It seems to me we are simply multiplying particulars. In certain epidemics other symptoms may be dominant, and if you keep on that way you will get any number of headings in here. You might as well add diarrhea, etc. It seems to me we are simply multiplying details needlessly.

Dr. DRAKE. Just one suggestion occurs to me that I think we overlooked yesterday, and that is the incorporation here of the new diagnostic symptom, pain on anterior flexion of the spine.

Dr. LAVINDER. The blank now has "Retraction of head."

Dr. DRAKE. Well, it fits right well in there.

The CHAIRMAN. "Pain on anterior flexion of spine."

Dr. DRAKE. Yes.

Dr. WOLFF. Mr. Chairman, here is a disease of which we know practically nothing, and we are endeavoring to obtain information. This outline on these slips is to be distributed throughout the United States for the purpose of collating the information we have and distributing it not only to the Public Health Service but to the State health boards and to the medical profession at large. The idea is to determine from this net collation of information just exactly what the usual and the unusual symptoms of this disease may be, in order that a proper diagnosis may be made. A gentleman on the other side of the house, from Indiana, states that his experience has been that a large part of these cases of poliomyelitis are accompanied by sweating, and I think that it is as important to obtain information on that symptom as it is to obtain information about something that was mentioned here by Dr. Draper yesterday. Even though the report may be made a little long, it will be attended with information that will be valuable to the medical profession of the country.

The CHAIRMAN. The chair would suggest that with the circular, in the differential diagnosis which will accompany the blank, these unusual symptoms can be given prominence. It could also be requested that physicians make note of any unusual symptoms.

Dr. ROBERG. Why not leave a blank space for unusual symptoms in the report and give the physician an opportunity to insert of his own initiative and in his own way whatever he chooses?

Dr. BURKART. I notice there is no space for remarks in this circular.

The CHAIRMAN. There is a space for remarks at the bottom of the second page. It says "Remarks. Please state any other facts of interest concerning the case."

Dr. BURKART. Why under the sun will not the intelligent practitioner place it there?

Dr. KING. The true symptoms would be of general interest. It occurs to me that in the circulars we have of the Public Health

Service and those distributed by the State boards of health, together with articles in scientific magazines, it has been stated that the virus of this disease is conveyed by the discharges from the nose or throat. It does not seem that this is an unusual symptom or an unusual condition, and a form which goes from a conference such as this which omits any mention of that most important matter would hardly be considered as covering the entire ground. While I am entirely willing to omit mention of the profuse perspiration as not being a matter of general interest, I do think that this conference should provide some way to report concerning the discharges from the nose and throat.

Dr. MANNING. I think the subject is important enough to include, because there is hardly a case where these symptoms are not looked for, particularly by the general practitioner.

The CHAIRMAN. In just what way would you put that in?

Dr. MANNING. "The presence or absence of nasal discharge."

Dr. BURKART. "Had the patient exhibited unusual nasal and throat discharges prior to the attack?"

Dr. WOODWARD. I do not think that stress should be placed on the nasal and throat discharges any more than on the intestinal discharges, whether yellow or dark, or hard or soft.

Dr. LAVINDER. Dr. Woodward has suggested that we might cut out that latter section, and put it on a separate blank. I do not think we want to multiply clinical data on a chart of this kind.

The CHAIRMAN. The question is now on the adoption of the section as read, which is headed, "Symptoms of acute stage."

Dr. DOWLING. What about lumbar puncture? It seems to me that is the most important consideration, especially with the abortive cases.

Dr. LAVINDER. The spinal puncture is a clinical, laboratory procedure which is secondary to the other features we are endeavoring to incorporate in this blank. I would like to hear from Dr. Frost on this.

The CHAIRMAN. Dr. Frost, what is your opinion regarding placing in this blank the results of spinal puncture?

Dr. FROST. I think it would be very desirable. It had not occurred to us before. This blank was made up several years ago, before spinal puncture had become a regular diagnostic method.

The CHAIRMAN. Where would you put this, on the first page? Would you make it "Results of spinal puncture"?

Dr. FROST. Yes.

The CHAIRMAN. Is there objection to inserting this in the blank? Without objection it will be inserted, "Results of spinal puncture," on the first page.

Dr. WOODWARD. Mr. Chairman, coming to the matter of clinical histories in blanks of this kind, unless we are going to use the

clinical histories that appear on these blanks for the purpose of eliminating cases which according to our own judgment are not poliomyelitis, we are going to get very little benefit from the information furnished. I do not believe there is anyone here who would undertake to revise the diagnosis of the attending physician on the basis of any such history as would appear on this blank. On the other hand, if we are going to collect clinical histories for the purpose of aiding in the diagnosis of the disease, we have to reckon very profoundly with the personal status and experience of the man who files the report. There is no one here, I believe, who would undertake, on the basis of data collected in this manner, to write a treatise on the differential diagnosis of anterior poliomyelitis.

I am of the opinion that the less we require in the way of clinical history on this blank the better it will be, with the understanding that any community that desires to collect clinical information can do so on a separate blank. I much prefer to trust to the clinical histories being collected by the expert diagnosticians in the city of New York at the present time than I do to the information that will be collected by thousands of physicians under varying circumstances throughout the United States, collected on blanks sent out to be filled during the rush of busy hours or turned over to some assistant to complete. I hope we will not unnecessarily extend the clinical history, and it seems to me we might almost with advantage omit it.

Dr. SWARTS. If this is adopted I should like to know how I should answer the question, "Results of spinal puncture? Did it clinically relieve the symptoms by relieving the pressure, or did you find nuclear cells?" How are you going to answer that? What are you going to do with it?

Dr. WOODWARD. Leave it out.

Dr. BURKART. I do not see, then, how you can get much of value. When you get through with this you will have several thousand cases recorded in New York City. If this information is added it will tend to make the blank more complex and defeat the purpose for which it is intended.

Dr. ROBERG. I move that this section of the blank be adopted as reported by the committee.

(The question was taken, and the motion was agreed to.)

Dr. BURKART. That is without the introduction?

The CHAIRMAN. Yes; without the introduction.

Dr. BURKART. Does that include the pain on anterior flexion of the spine?

The CHAIRMAN. That is at the bottom of the first page. Is there a second to this motion?

(The motion was again seconded, and the question being again taken, the motion was carried.)

Dr. BURKART. Does that include the two lines on the other side?

The CHAIRMAN. Yes; that was in the committee's report.

Dr. LAVINDER. The next section is:

OUTCOME OF CASE TO DATE.

Recovery (complete disappearance of paralysis)_____
Improvement, extent of paralysis remaining?_____
Death, date_____

Dr. HOFFMAN. I would suggest that after "death" you say first "immediate cause," and "primary cause," and second, "contributory cause." In the subsequent investigations of this disease it may be possible to ascertain what contributory causes occurred at the time of death. I would further suggest that you add a new line there, asking whether the diagnosis was confirmed by autopsy or not.

The CHAIRMAN. Are there any further suggestions regarding this section?

Dr. WOODWARD. With a view to retaining uniformity of nomenclature and in order to meet as far as possible the suggestions of Dr. Hoffman, I suggest that we might with advantage, under the term "death," use the phrases that are already in use in the standard certificate of death.

Dr. HOFFMAN. Yes; precisely.

Dr. WOODWARD. Insert there the phrases used in the standard certificate of death.

Dr. LAVINDER. That would not make a question at all, but just a direction.

The CHAIRMAN. Yes; just a direction. What does the conference think of this suggestion?

Dr. WATSON. I move its adoption.

(The motion was seconded.)

The CHAIRMAN. It has been moved and seconded that this section be adopted as read, including this question of the phraseology.

Dr. WOODWARD. Of the phraseology of the standard death certificate.

Dr. BURKHART. Just that phraseology.

(The question was taken, and the motion was unanimously agreed to.)

Dr. LAVINDER. The next section is "Contact with previous cases." The first question is, "Had patient been associated with any previous case?" Then there is inserted:

If so, state whether paralyzed or abortive case; give name, address, and date?__
Had any member of the patient's family been associated with any previous case?

If so, state whether paralyzed or abortive. Give name, address, and date.

Had patient or member of family visited any place? _____

2. Had any visitor been to see family? _____

Did patient attend school? _____. Where? _____. Grade? _____.

What were the weather conditions immediately preceding this attack? Hot, mild, cold, wet, dry, dusty; unusual in any respect? _____

Have any infective diseases, respiratory or digestive trouble, or unusual disorder of any kind been unusually prevalent in the community? _____

What animals or fowls were kept on the premises within month preceding attack? _____

Has there been any paralysis of animals or fowls in the vicinity? _____

What preventive measures were carried out? _____

Remarks: Please state any other facts of interest concerning the case_____

Date of filling out report_____

Signed _____, *M. D.*

Address _____.

Dr. WOLFF. Mr. Chairman, on the question, What immediate contact has patient had with domestic animals? I would say that there is a very widespread opinion among medical men that the domestic cat and dog have much to do with the spread of the disease, and in a circular of this character we would obtain an enormous amount of information in that regard which might turn out to be of inestimable value.

The CHAIRMAN. The Chair will entertain a motion for the adoption of this section.

Dr. BURKART. I move that the section be adopted, with the amendments inserted, as read.

Dr. WATSON. I second the motion.

(The question was taken and the motion was agreed to.)

Dr. SWARTS. The report, as a whole, now has to be adopted. I move that it be adopted as a whole.

(The motion was seconded, and, the question being taken, the motion was agreed to.)

(The blank which the conference finally adopted was as follows:)

[Treasury Department, Public Health Service, August, 1916.]

State of_____ Year_____ Case No_____

CASE REPORT OF POLIOMYELITIS (INFANTILE PARALYSIS).

(Form adopted by the conference of State and Territorial health authorities with the Public Health Service, Aug. 18, 1916.)

1. Patient's name_____; age_____; sex_____; color_____
2. Nationality of father (*a*)_____; of mother (*b*)_____
3. Occupation of father (*a*)_____; of mother (*b*)_____
4. Residence (post office)_____; county_____
5. Did patient live in city?_____; village?_____; country?_____
6. If in country, state distance from center of nearest town or village_____

7. Status of family: Well-to-do_____; moderate_____ poor_____
8. Sewage disposal: Flush closet_____; cesspool_____; privy_____
9. General sanitary conditions on premises: Excellent__; good__; fair__; bad__
10. Previous general health of patient: Excellent_____; good_____; poor_____
11. Had patient suffered from any illness, indisposition, or accident within a month prior to this attack?_____
12. Nature of illness or accident_____

OTHER MEMBERS OF FAMILY (INCLUDING GUESTS, BOARDERS, AND SERVANTS).

13. Children: Males (age of each)_____; females (age of each)_____
14. Adults: Males, number_____; females, number_____
15. Were there any other cases of sickness in the family within one month before or after this attack?_____
16. Give name, age, sex, date, and nature of each case_____

SYMPTOMS OF ACUTE STAGE.

17. Fever: High_____; moderate_____; slight_____; none_____
18. Headache: Severe_____; moderate_____; slight_____; none_____
19. Constipation____ 20. Diarrhea____ 21. Vomiting____ 22. Sore throat____
23. Pain_____; distribution_____
24. Tenderness_____; distribution_____
25. Retraction of head_____ 26. Restlessness_____ 27. Drowsiness_____
28. Pain on anterior flexion of spine_____
29. Date of onset: Of acute symptoms (*a*)____; of paralysis, if any (*b*)____
30. Distribution of paralysis at its worst_____
31. What treatment was employed, and with what apparent results?
    (*a*) In acute stage_____
    (*b*) Subsequent to acute stage_____
32. What preventive measures were carried out?_____

OUTCOME OF CASE TO DATE.

33. Recovery (complete disappearance of paralysis)_____
34. Improvement_____; extent of paralysis remaining_____
35. Death_____; date_____
    (Follow standard death certificate in stating cause of death.)

CONTACT WITH PREVIOUS CASES.

36. Had patient been associated with any previous case?_____ If so, state whether paralyzed or abortive case_____; give name, address, and date of case_____

37. Had any member of the patient's family been associated with any previous case?_____ If so, state whether paralyzed or abortive_____; give name, address, and date of case_____

38. Had patient or any member of family visited any other community within one month prior to attack?_____ If so, give places visited and dates_____

39. Had patient's family received any visitors from other communities within one month prior to attack?_____ If so, from what places, and when_____

40. Did patient attend school?_____; where?_____; grade_____

41. What were the weather conditions immediately preceding this attack? Hot_____; mild_____; cold_____; wet_____; dry_____; dusty_____; unusual in any respect_____

42. Have any infective diseases, respiratory or digestive troubles, or unusual disorders of any kind been unusually prevalent in the community?_____

43. What animals or fowls were kept on the premises within one month preceding attack?_____

44. Had there been any paralytic disorders of animals or fowls in the vicinity?_____

REMARKS.—Please state any other facts of interest concerning the case:

_____

Date of filling out report_____

Signed _____, *M. D.*

Address _____.

The CHAIRMAN. I would suggest to the chairman of this committee that there is one point on which the committee has not reported, and that is as to the uniformity in stating the age period.

Dr. LAVINDER. That was in the other blank on the age period. There are two blank forms which have not come down.

The CHAIRMAN. Will you report on that?

Dr. LAVINDER. When it comes down; yes, sir.

Dr. RANKIN. Mr. Chairman, how long will it be before the Secretary of the State board of health will get a copy of this form?

The CHAIRMAN. I think we can send out typewritten copies almost immediately.

Dr. RANKIN. We would like to have them immediately.

The CHAIRMAN. And of course printed copies will be sent out later.

Dr. RANKIN. Then a motion is unnecessary.

The CHAIRMAN. We will arrange to have that done immediately. We wish all of the members to fill out this report on poliomyelitis before they leave.

It was suggested that a standing committee on the collection of poliomyelitis statistics be appointed by the conference. What is

the wish of the conference regarding this suggestion? Does the conference wish a standing committee appointed on the collection of poliomyelitis statistics?

(There was no response.) Evidently the conference does not. We will consider the matter closed.

Dr. WOODWARD. Mr. Chairman, I do not believe that we need a committee on poliomyelitis statistics, but it seems to me we might well have a committee on poliomyelitis. I move that the chairman appoint a standing committee of five to study the subject of poliomyelitis and to report to the conference from time to time as it may be convened.

Dr. SWARTS. I second that motion.

The CHAIRMAN. It has been moved and seconded that the chair appoint a committee for the purpose of studying and reporting from time to time to the conference on the subject of poliomyelitis. Is there any discussion?

(The question being taken, the motion was agreed to.)

Dr. LAVINDER. These other two blanks are put on one page and they will be properly arranged later. This gives the distribution of cases by ages, sources, and by States, counties, and so on. It will go on two forms, presumably. I will distribute these copies.

The CHAIRMAN. The conference will now receive the report of the committee on measures to prevent the intrastate and interstate spread of poliomyelitis. Dr. John S. Fulton.

REPORT OF THE COMMITTEE ON INTERSTATE AND INTRASTATE SPREAD OF POLIOMYELITIS.

Dr. FULTON. Mr. Chairman and gentlemen of the conference, your committee appointed yesterday to consider the interstate and intrastate spread of poliomyelitis met the afternoon of the same day and undertook to make as condensed a statement as it could, covering the vital points of the situation, but by no means exhausting the details of prevention of the spread of the disease. The committee has put forth certain minimum requirements and certain statements of principles and of practices. At the present moment only six copies of the report are available, but additional copies are being prepared and will soon be ready for distribution. I will ask you to pay very close attention to the reading:

REPORT OF THE COMMITTEE ON MEASURES FOR THE PREVENTION OF INTERSTATE AND INTRASTATE SPREAD OF POLIOMYELITIS.

I. It is the sense of this committee that the first step proper to be taken by a State health authority, believing its territory to be in danger of an invasion by poliomyelitis from another State or part of a State, is to call the attention of

the United States Public Health Service to the situation believed to be dangerous, and to request the United States Public Health Service to take whatever steps are necessary to prevent the interstate spread of poliomyelitis.

II. The necessary steps, ordinarily to be taken by the United States Public Health Service in such a contingency are believed to be:

(1) Investigation of the infected area.

(2) Notification concerning the removal of persons, 16 years of age or under, from an infected area to a named point of destination in another State, said notification to be addressed in every case to the State health authority of the State of destination.

(3) The forms of notification and of health certification and of permits to travel should include the following information and specifications, with such additional information and specifications as the United States Public Health Service deems necessary:

Identification of each traveler, the exact location of present or usual residence, and record of premises as to freedom from poliomyelitis during the preceding three months; or as to latest date of infection if less than three months; or as to renovation or cleansing of premises after infection.

(4) Permits to travel shall be void unless the journey shall begin within 24 hours after issue of the permit.

(5) Single permits shall not be issued for several persons, except for family or household groups coming from the same domicile.

(6) The collection of fees, by health officials, from applicants for permits, whether resident or nonresident, should not be permitted.

(7) The certificates of private physicians will not alone be a sufficient basis for the issue of a permit to travel. Permits for interstate travel will be based on medical examination.

(8) Permits for interstate travel should be signed by an officer of the United States Public Health Service, or by the State health officer, or by an officer authorized by the State health authority.

III. The committee disapproves quarantine by one State against another State, or quarantine by one community against another community in the same State. It is believed that the Federal Government, through the United States Public Health Service, can perform all the duties of notification and certification required in interstate relations in case of unusual prevalence of poliomyelitis, and that State health authorities can and should perform like services as between communities in the same State during unusual prevalence of poliomyelitis.

IV. It is recommended that all cases of poliomyelitis should be reported immediately to the local health authorities and to the State health authorities, and that State health authorities make weekly reports to the United States Public Health Service of all cases of poliomyelitis. The United States Public Health Service is asked to furnish general reports weekly.

V. It is recommended that all persons 16 years old or under, with a clean bill of health, and removing from an infected area or district to another locality should be kept under medical observation daily for two weeks from the date of the certificate.

VI. It is believed that the period of isolation of a case of poliomyelitis should be not less than six weeks from date of onset.

VII. The isolation of cases of poliomyelitis should be stringent isolation of the sick person with attendant or attendants, in a properly screened room or rooms, with disinfection at the bedside of all bodily excretions. Wherever it is possible the removal of patients to a hospital is greatly to be preferred to isolation in a private house or apartment.

VIII. In case of death from poliomyelitis the funeral should be strictly private.

IX. Wherever poliomyelitis is unusually prevalent, assemblages of children in public places should be prohibited.

X. During unusual prevalence of poliomyelitis, schools should not be opened without thorough medical supervision by a health authority. When schools are opened, beginning should be made with high schools, and proceeding to lower age groups no more rapidly than complete medical examinations can be made.

XI. Because of the existence or unknown carriers of the infectious virus of poliomyelitis and because the infectious virus is present in the body discharges of such persons, therefore all measures to prevent contamination by human excreta or other bodily discharges, the suppression of the fly nuisance, prohibition of the common drinking cup, and a general educational campaign for cleanliness and sanitation, with particular instruction of parents and children concerning personal hygiene, especially of the mouth and nose, are strongly urged by the committee.

XII. To aid in preventing the spread of poliomyelitis, common carriers should instruct their agents and ticket sellers, by direct order as well as by public notices, when poliomyelitis is unusually prevalent, that travelers with children of 16 years or under must be provided with a health certificate as detailed in another section of this report.

XIII. The epidemic prevalence of poliomyelitis in certain States at this time indicates a probability of epidemic prevalence next year in States not gravely affected at the present time. It is believed that the measures here recommended should be continued in operation at least until such time as the incidence of the disease has subsided to or below its usual level.

JOHN S. FULTON.
T. D. TUTTLE.
H. M. BRACKEN.
ENNION G. WILLIAMS.
CHAS. E. BANKS.

Dr. FULTON. This report was framed, Mr. Chairman, with the hope that it would not be accepted without thorough and free discussion, and also in the hope that if possible it will be adopted without amendment, or at least without extensive amendment. The committee, I think, has undertaken to come right down to basic principles in solving the vital problem that confronts us. Some things are desirable to be done in extension of practices here recommended, but I think certainly not in abbreviation of the details outlined.

Dr. BLACK. Mr. Chairman, I move that the report be adopted as read.

(The motion was seconded.)

Dr. COLLINS. Under the head of distribution of the disease a question arises which has not been mentioned, I believe, and that is as to the shipping of dead bodies from point to point; whether that should be allowed, and if allowed, under what conditions.

Dr. BURKART. That is provided for in every State through an embalmers' law.

Dr. COLLINS. Yes; but in this particular disease it is not.

Dr. SWARTS. We have not time this morning to go into that discussion. A good many of us want to get away at an early hour, and if we take up the subject of the transportation of the dead there is no telling how long we will be here. I move that the question be left until the next conference.

Dr. BLACK. While I moved the adoption of this report and am thoroughly in favor of it, there are certain matters in regard to which I should like to know what action will be forthcoming. In certain ports of entry as many as 2,000 New York children have arrived in one week from infected areas. We recommend examination, registration, and observation; but it is obvious that this is impossible for 20,000 or 30,000 or even 10,000 persons without great expense. I think many of the local authorities have the power to adopt more stringent regulations than are adopted by the State board of health. Now, if they decide to act without the advice of the State board of health, what is the State to expect from the Federal authorities if they should take such action?

Dr. WOODWARD. I move that the report be read section by section and discussed in that manner.

Dr. RANKIN. I second that motion.

(The question was taken, and the motion was agreed to.)

The CHAIRMAN. It is so ordered. Dr. Drake will read the first section.

Dr. DRAKE. The first section reads:

1. It is the sense of this committee that the first step proper to be taken by a State health authority believing its territory to be in danger of an invasion by poliomyelitis from another State or part of a State is to call the attention of the United States Public Health Service to the situation believed to be dangerous and to request the United States Public Health Service to take whatever steps are necessary to prevent the interstate spread of poliomyelitis.

I move the adoption of that section.

(The motion was seconded, and the question being taken, the motion was agreed to.)

The CHAIRMAN. It is carried. The second section reads:

II. The necessary steps ordinarily to be taken by the United States Public Health Service in such a contingency are believed to be:

(1) Investigation of the infected area.

(2) Notification concerning the removal of persons, 16 years of age or under, from an infected area to a named point of destination in another State, said notification to be addressed in every case to the State health authority of the State of destination.

(3) The forms of notification and of health certification and of permits to travel should include the following information and specifications with such additional information and specifications as the United States Public Health Service deems necessary:

Identification of each traveler, the exact location of present or usual residence, and record of premises as to freedom from poliomyelitis during the preceding three months; or as to latest date of infection if less than three months; or as to renovation or cleansing of premises after infection.

(4) Permits to travel shall be void unless the journey shall begin within 24 hours after issue of the permit.

(5) Single permits shall not be issued for several persons, except for family or household groups coming from the same domicile.

(6) The collection of fees, by health officials, from applicants for permits, whether resident or nonresident, should not be permitted.

(7) The certificates of private physicians will not alone be a sufficient basis for the issue of a permit to travel. Permits for interstate travel will be based on medical examination.

I am not clear as to that.

(8) Permits for interstate travel should be signed by an officer of the United State Public Health Service, or by the State health officer, or by an officer authorized by the State health authority.

Dr. BURKART. What is the point you said you were not clear upon?

The CHAIRMAN. It is not entirely clear as to the latter part of subsection 7, which says, "Permits for interstate travel will be based on medical examination." Does that mean really a medical examination?

Dr. FULTON. I would be glad to hear anybody suggest a substitute for that.

The CHAIRMAN. To give a man a medical examination requires time. I would suggest that it should be medical "inspection" instead of "examination." I would be glad to hear from Dr. Banks on this subject.

Dr. BANKS. The idea we had in mind was that the officer issuing the permit should make the inspection or examination.

The CHAIRMAN. Is it agreeable to the committee to substitute "inspection" for "examination"?

Dr. BRACKEN. What were the words, "medical inspection"?

Dr. BANKS. They were "medical examination." A medical inspection is an examination.

Dr. FULTON. Dr. Tuttle, how does this strike you, "inspection"?

Dr. TUTTLE. All right.

The CHAIRMAN. Is there further discussion of this subject?

Dr. RANKIN. I move the section be adopted.

The CHAIRMAN. Is there any discussion?

Dr. YOUNG. I do not know how many tourists we receive, but we have about 20,000. This would throw quite a large burden upon the health officer, to do all the work of making out certificates, and he receives nothing for it.

Again, in the northern and central parts of our State in the wild woods toward Moosehead Lake, we have two very large hotels. There

is just one physician near there. The country is wild, unorganized, and there are no health authorities. The doctor has a commission from the State board of health as a sort of sanitary watchdog or inspector. Supposing that I should delegate this man up there at Kineo to issue certificates, it would throw quite a burden of work upon him, and he receives no fee. I would suggest whether it might not be better, instead of making an absolute prohibition of taking fees for this service, to say what the maximum fee shall be, perhaps 25 cents.

Dr. BURKART. Oh, no.

Dr. FULTON. I should like to say that I would object to any change in the verbiage, for this reason. I think that an amendment of that sort would imply a greater force in this whole document than actually exists. In some parts of the country, abuses are sure to eventuate from the collection of fees. We are not writing here a law that is going to be approved by the governor of a State, but we are expressing an opinion, and a very decided opinion, about the collection of fees. I do not conceive that that would in any wise embarrass Dr. Young in the very peculiar and unusual situation he has there, and if we should attempt to make provisions here for very unusual circumstances, outside of extreme probability, we will meet with all sorts of difficulty.

Dr. KERR. I would like to suggest that at some time during the discussion the act of February 15, 1893, be read.

The CHAIRMAN. The chair will read that act now, and there are copies of it here available for distribution. Beginning on page 8 of the interstate quarantine regulations, section 3 of the act reads as follows:

SEC. 3. That the Supervising Surgeon General of the Marine-Hospital Service shall, immediately after this act takes effect, examine the quarantine regulations of all State and municipal boards of health and shall, under the direction of the Secretary of the Treasury, cooperate with and aid State and municipal boards of health in the execution and enforcement of the rules and regulations of such boards and in the execution and enforcement of the rules and regulations made by the Secretary of the Treasury to prevent the introduction of contagious or infectious diseases into the United States from foreign countries, and into one State or Territory or the District of Columbia from another State or Territory or the District of Columbia; and all rules and regulations made by the Secretary of the Treasury shall operate uniformly and in no manner discriminate against any port or place; and at such ports and places within the United States as have no quarantine regulations under State or municipal authority, where such regulations are, in the opinion of the Secretary of the Treasury, necessary to prevent the introduction of contagious or infectious diseases into the United States from foreign countries, or into one State or Territory or the District of Columbia from another State or Territory or the District of Columbia, and at such ports and places within the United States where quarantine regulations exist under the authority of the State or municipality which, in the opinion of the Secretary of the Treasury, are not sufficient to prevent the introduction of

such diseases into the United States, or into one State or Territory or the District of Columbia from another State or Territory or the District of Columbia, the Secretary of the Treasury shall, if in his judgment it is necessary and proper, make such additional rules and regulations as are necessary to prevent the introduction of such diseases into the United States from foreign countries, or into one State or Territory or the District of Columbia from another State or Territory or the District of Columbia, and when such rules and regulations have been made they shall be promulgated by the Secretary of the Treasury, and enforced by the sanitary authorities of the States and municipalities, where the State and municipal health authorities will undertake to execute and enforce them; but if the State or municipal authorities shall fail or refuse to enforce said rules and regulations the President shall execute and enforce the same and adopt such measures as in his judgment shall be necessary to prevent the introduction or spread of such diseases, and may detail or appoint officers for that purpose.

The remainder of the section is not pertinent to the subject under discussion, and will therefore not be read.

Dr. PORTER. Mr. Chairman, while it is a fact that this section may apply in a general way to communicable diseases throughout the United States, it is also a fact that this law was passed after the great epidemic of yellow fever; I think it was in 1905——

The CHAIRMAN. This was in 1893.

Dr. PORTER. Well, then, in 1888.

The CHAIRMAN. Yes.

Dr. PORTER. I know in a general way it is applicable to all communicable diseases, yet it was especially directed at that time at yellow fever. If it is true that it can be made to apply to all communicable diseases from one State to another, then there is no work for this conference to do. The whole matter is in the hands of the Public Health Service to take charge of.

Dr. BURKART. Is it not a general inference of the common law that in the absence of a prohibitory enactment this law stands? There is nothing which says that it shall not apply to all dangerous communicable diseases. If there is nothing said to the effect that it shall not apply, certainly it must apply.

Dr. TRASK. The law of 1893 provided that the existing regulations of States and municipalities should be examined to ascertain whether they complied with a given standard of efficiency. This implied a degree of confidence in and the placing of responsibilities upon the State and local authorities. The same law provides that the State and municipal authorities shall enforce any regulations which may be promulgated to prevent the interstate spread of disease if they will do this voluntarily. This also shows the important part which it is intended the State authorities shall take in the enforcement of the provisions of the law and of any regulations which may be made pursuant thereto.

In regard to the law of 1902, which specifically provides for conferences of the State health authorities with the Public Health Service, there seems to be no reason to doubt that those who drafted the law and the Congress which adopted it were conversant with the provisions of the act of 1893 and the provisions of its section 3, and that the conferences were provided for in the later law with full knowledge of and having in mind the provisions of the act of 1893. These points are brought out because it is believed that they indicate that the provisions of the section read by the chairman and the provisions of subsequent laws emphasize the importance of this conference and its necessary relation to the interstate control of disease, and particularly to the discussion of such matters as that for which this conference has been called.

Dr. WOODWARD. I move that we return to the regular order.

The CHAIRMAN. The Chair was about to remark that we are straying from the subject of discussion. There is a motion before the conference for the adoption of section 2, and this is under consideration. Gentlemen will please confine their remarks to the discussion of the motion before us.

Dr. DRAKE. I rise for information. I should like to know what the life of each of those certificates would be? What is the period of time that the certificate is good for, for purposes of travel?

The CHAIRMAN. It is good until the end of the journey.

Dr. FULTON. Do you mean the certificate or permit?

Dr. DRAKE. The permit to travel.

Dr. FULTON. The beginning of the journey must occur within 24 hours from the date of the issuance of the certificate. The certificate itself is to be sent by the Public Health Service directly to the health officer at the point of destination, after which time the health authorities assume their function. As to the life of that certificate, it is certainly not intended that the certificate shall be used for more than one journey. As a certificate, it is invalid when the journey is completed.

Dr. DRAKE. I should also like to ask how this requirement relates to suburban travel. There are several hundred thousand people who travel to suburban points every day. Are they going to be required to have certificates for that purpose? Some of those communities are infected points.

Dr. FULTON. That is one of the things that the committee thought it ought not to venture into, the handling of commuters, week-end excursionists, and the movements of persons engaged in certain industries, such as the canning industry. This committee did not think it was able to handle questions of that sort. Those are matters which, we think, should be left untouched, because they can be decided much better by local authorities.

Dr. DRAKE. Then one other question I wish to ask——

Dr. BANKS. In relation to the manner in which commuters leaving New York City are cared for, it is by issuing seven-day certificates to boys—they are mostly boys who are engaged in office work—between Jersey City and points in New York City. We issue to them a travel card lasting one week.

The CHAIRMAN. The conference will note that this applies to children under 16 years of age, and not to regular adults.

Dr. DOWLING. There are a number of people who go from Bay St. Louis to New Orleans. Then there are many people who go from New Orleans on Friday and come back on Monday evenings.

Dr. DRAKE. Inasmuch as a large number of the health authorities in the small communities in our State are not medical men, and therefore would not be considered competent to make this health inspection and issue the certificate, another difficulty arises.

Dr. BRACKEN. This certification is necessary only from those places where infantile paralysis prevails, so that you would not have to appoint many thousands for a State. The whole intent of this clause is to protect the State officials in doing their business. The point is that if we do not put in there State or local health officers we will encourage certification by a lot of inferior men, men whose certificates we would not want to see accepted, interstate or intrastate.

Dr. DRAKE. One or two other points. Is it the purpose of this conference to issue a uniform type of certificate, or is it left to the individual States to issue the certificates they see fit, incorporating the items recommended by the committee?

Dr. FULTON. It is confidently believed that with the adoption of these regulations a uniform certificate, recognizable at a glance as authoritative, will come into existence. We could specify that it should carry a seal of an authoritative character as a guaranty, I think, as much as it is right for this conference to undertake to guarantee them. Such was our intention.

Dr. DRAKE. Would it not be well for the United States to issue its own certificate? Then, one other question. Of course this is only where there is a child under 16 years of age. I believe it is generally assumed or generally acknowledged that the adult may be a carrier as well as a child. Are you going to permit adults from infected premises to travel on health certificates?

Dr. FULTON. The committee accepted the limit of 16 years, since it is current practice at this time. It in no way restrains the powers or the rights of local authorities to make a limit beyond that if they desire.

Dr. FROST. Mr. Chairman, I certainly hesitate to throw any further complications into such an intricate situation as this, but the question that has just been raised does seem pertinent. I think this

conference, in adopting any regulations which require so much work and machinery, might look into what may be accomplished in the prevention of the spread of the disease. Now, if we are working on the assumption that poliomyelitis is a contagious disease, an inevitable corollary, therefore, is that we have adult carriers who are the major factors in the spread of the infection. I think the facts and figures will show that the exclusion of children under 16 will cover only a very small part of the problem. They constitute only a small fraction of the total travel. We have no reason to believe that they are more dangerous as carriers than adults; and how much of the problem are we really covering when we are excluding children under 16? I recognize, of course, that there are certain considerations of policy and practicability; but might not that be a subject, anyhow, for consideration and discussion?

Dr. WOODWARD. It seems to me, Mr. Chairman, that the reason stated by Dr. Fulton for adopting the 16-year limit is the very reason why we should not adopt it. Dr. Fulton says we are to adopt it because it is current practice. We know it is current practice; but who is there here who can show that the issuance of these certificates based on an age of 16 years as a limit has prevented the spread of the disease in the least? I do not believe there is any evidence that it has done so; and if that is the case, we must either have the courage of our convictions or stultify ourselves before the public. We must have some sound basis for the age limit. Dr. Frost has already said that the number of children in interstate traffic is small. There is another reason why we may say, relatively, that the children are a safer element in the travel problem than adults; that is, by reason of their susceptibility to the disease. The child in interstate travel comes down with the disease, and the condition is recognized and the child is quarantined, while the adult is never discovered. I believe the age limit ought to be abandoned altogether, and we ought to enforce these regulations against the entire body of the community or ought not to undertake to enforce them at all.

Dr. RANKIN. That is right, exactly.

Dr. FULTON. As chairman of the committee, I do not feel in anything like the degree Dr. Woodward has expressed, that we should as one alternative do nothing, or as the other, take off the age limit entirely. We have proceeded upon the basis of experience in this present epidemic, and certainly I would not dare assert, as it has been asserted here this morning, that the specification of this limitation of the age of 16 has been of no profit. I think a man makes an unwarrantable assertion in saying such a thing as that. I conceive that this limitation has done good and will do good, and I will say also that I think there is no sound reason for raising

the limit at the present time. The committee does not intend to make any departure from that which experience seems to us to have justified, and which certainly has the sanction of authority. It leaves this conference quite free to extend the age limit if it desires. In my own judgment this extension is not warranted, because it would result in some of the confusion which we are trying if possible to avoid. I do not feel that this section would be improved by altering the age limit. I am also inclined to think that there is some tendency to exaggerate the potentialities of adult carriers, and I consider that the restriction of the movements of persons who are at the susceptible age the most important desideratum. I also call attention to the extreme difficulty of recognizing adult carriers.

Dr. HOFFMAN. I rise with great reluctance, but I feel very strongly with Dr. Woodward that the age limit of 16 years is arbitrary, unjustifiable, and can not be sustained. I have here references of 1,200 cases that show there were practically no deaths whatever above the age of 14 years. It shows there were more deaths at 14 than at 15, 16, or 17. Why should the line be drawn at 16 years? We have to admit that it does not make much difference whether the age limit is 7, 8, 9, 10, or 11, or 12. I have a boy now held in a two weeks' quarantine, who went from New Jersey to New York. We traveled without interference under a certificate, and nobody even looked at the document. That certificate is over a week old, and it is not stamped, and it does not mean anything except that it has a place upon it for a stamp. Yet that boy of mine is being kept at home and can not travel because he is not quite 16 years of age. I suggest that you draw the line at 14 years of age if you draw it at all.

Dr. LEAKE. I support strongly what Dr. Hoffman says, that there is no reason for drawing an age limit.

Dr. RANKIN. Mr. Chairman, I am in full sympathy with what Dr. Woodward said, and also with what Dr. Hoffman has said. Now, when the health officer goes in and recommends certain measures, and people adopt those measures, they look to that officer for results. I, for one, do not believe that the present method of handling this epidemic is worth anything, hardly. I do not know what the literature will show, but they had an epidemic several years ago in New York when few of these measures were taken and they did not have near the susceptibility that they have to-day, with all the measures adopted. I expect that an investigation of all the epidemics in the country would show that there is no higher incidence where practically nothing is done than in those cases where they take all these pains.

It amounts to this, that I must go back to the people and say to them, "I can not control this disease without the control of all possible carriers, and that means 400 or 500 people in these towns up here. Do you folks want me to do that? If you do, pass this law. If you do not, understand that I wash my hands of it." That is just the situation. We go and recommend something that does not get results; and what health officer in this audience would feel easy with the present methods of managing infantile paralysis? Either that, or we go before those people and say, "Here, we can not control the disease because there are more carriers than sick people. Now, the only possible way for you folks—not me—to control this outbreak is to quarantine all of them, all possible suspects, adults, and children alike." As the situation now stands in this country the people are placing the responsibility of failure to stop the disease upon the health officers, and that is what they have a right to do, if we keep on with the present methods. We have got to tell them that those methods are not getting results, and that the only methods that will get results are very stringent and radical, thus throwing upon them the responsibility of declining the more radical measures.

Dr. BANKS. Mr. Chairman, so far as my experience goes we are under no delusion that the notification system which we have adopted will prevent the spread of poliomyelitis, unless the health officers do their duty after we have notified them. That is the purpose of the whole system, and the assumption of an arbitrary age is one that can be changed if deemed proper. We said 16. If it is the wisdom of the conference that it should be 14, that is to be accepted. This system is not one of quarantine; it is merely one of regulation of traffic, and to undertake the control of adults would involve practically a quarantine of the entire country. You have got to stop somewhere in a system of this sort which singles out a class of persons who are affected directly by the disease.

Dr. WOODWARD. But, Mr. Chairman, does not Dr. Banks see that if it is safe for an adult to come from a sick room and go into interstate travel without restriction, or to come from an infected house and go into interstate travel without restriction, we must absolutely lay down the same rule with respect to his conduct in his own community? We can not say to this man who is living in a placarded house, "Come, you are 16½ years old. Take this car and go down to this picnic," simply because he is over 16 years old. If we undertake to fix the limit at 16 for travel, we must fix it at that age for all purposes.

Dr. BANKS. Mr. Chairman, it seems to me that the local health regulations regarding infected places and infected families cover such instances. Persons coming from infected houses can not go out without defiance of the law.

Dr. WOODWARD. That is the point. The disease recognizes no difference between interstate regulations and local regulations, and we can not logically waive the age limit for national purposes and establish it for local purposes. Such an assumption would be utterly unjustifiable on any scientific principle or logical basis.

Dr. FULTON. Do you state that as a lawyer, Dr. Woodward? I do not conceive that the local authorities are limited in their power to make regulations as to internal movements. I should not hold that view myself as a health officer.

Dr. WOODWARD. I thought I tried to make it definitely understood that it was within the power of the local boards to do.

Dr. FULTON. Yes.

Dr. WOODWARD. And I think the record will sustain me in that. The point I make is that, whatever their power may be on the basis of the law, that on the basis of facts they will find nothing to sustain them. They have local authority to do a great many things that science and logic do not justify.

Dr. KERR. Mr. Chairman, it seems to me I might perhaps interpret for the bureau the object of the work that is going on. There appears to have been some misunderstanding of the proposed or presumed value of the work. We start out in public-health work with the assumption that knowledge is a valuable thing—knowledge of the geographic occurrence and prevalence of disease. We are collecting death and case reports from all over the country, and that has been a practice for many years. We are not doing it with the object of guaranteeing that we, or the health officers cooperating with us, will relieve the people of the presence of disease. I think all the officers here feel that the work at New York is just a little more acute method of furnishing information to State and local health authorities for such use as it is possible in the present state of our knowledge for them to make of it. It must not be assumed in furnishing these certificates that we guarantee the persons free from poliomyelitis.

As I understand it, the certificates mean simply that those persons to whom they are issued have come from a certain place and are going to another place, and this information is furnished in order that the local health authorities may be on the lookout. I think that we should be entirely frank with ourselves and with the public as to what we expect to accomplish. In my judgment the situation is not as serious as it might be, but we have got to face it together, and we must take the public into our confidence and make the best of it. I feel that the question at the present time, therefore, whether a frank system of notification, such as has been inaugurated and carried on thus far, is of service to State and local authorities or not, is the primary question to be settled here. If it is not of service, it seems

to me it would not be a good plan for this country to adopt it generally. If it is a good plan, then, by all means it seems to me that the notification system should include all infected localities, and be participated in by the Federal, State, and local authorities who are a part of the national health service. For that reason I suggested that the section of the law pertaining to this subject be read.

Dr. PARLETT. Mr. Chairman, by restricting the travel of those under 16 years of age, do we not at least protect those at the susceptible age from possible contraction of the disease, and those with whom they come in contact at the point of destination who are of susceptible age? Do we not, therefore, at least to some extent, modify the spread of disease?

Dr. BRACKEN. Mr. Chairman, it seems to me we are doing a lot of talking and are not getting anywhere. There are just a few words concerning the age limit that you are quarreling over. It seems to me, therefore, that some one should move to take out the age limit entirely, or to lower the limit. I am on the committee, and before I came down here Dr. Fulton said if I was not on the committee I would be raising a row all the time, so I will try to keep quiet.

Dr. SWARTS. I understand Dr. Woodward's point to be that the certificate will say, "This is to certify that Mary Smith, age 6 years, is free from infantile paralysis," and then that its parent, age 62, may be a carrier.

Dr. PORTER. How is he to know?

Dr. SWARTS. That is it—how is he to know? Therefore I would certify, "I can not certify as to the father. As to the father, you take your chances."

Mr. BANKS. I would like to suggest that in limiting the travel of children under 16 you also limit the parents and guardians who go with them. It is very rare that children travel alone.

Dr. BOUDREAU. I would like to protest against the expense that will be placed upon State departments of health if these notifications are sent to them and have to be forwarded to the health officers in the different localities. I think they should be forwarded to the State department of health, and the State department of health can discriminate and see that the notifications are looked after when the local health officer is not efficient. I know we have not the personnel in our State to look after that kind of work.

Dr. BRACKEN. I would ask if the doctor has been in official work very long; and if he has, how he would like discriminating between Dr. A. and Dr. B., 6 miles apart? I think he would find himself in a rather unpleasant situation.

Dr. WOODWARD. I would move to amend this section by striking out, under Section II, the words "sixteen years of age or under."

(The motion was seconded.)

Dr. BRACKEN. How will it read then?

The CHAIRMAN. It will then read:

Notification concerning the removal of persons from an infected area to a named point of destination in another State, said notification to be addressed in every case to the State health authority of the State of destination.

You have heard the motion. Are you ready for the question?

Dr. PARLETT. What is the purpose of it?

The CHAIRMAN. The purpose is to cover all persons.

Dr. PORTER. Then, do I understand that all persons living in New York City, of whatsoever age, must get a certificate?

The CHAIRMAN. It says, "from an infected area."

Dr. SWARTS. What constitutes an infected area, one case in a hundred?

Dr. FULTON. Oh, my; we do not go into that.

The CHAIRMAN. Are you ready for the question?

Dr. WILLIAMS. I would like to move as a substitute, that instead of leaving that out we insert "fourteen years or under"; so that we have three propositions, 16 or under, 14 or under, or to omit mention of any age limit. It seems to me it is impracticable to furnish certificates for everybody traveling out of New York City.

The CHAIRMAN. It has been moved and seconded that we substitute for the motion of Dr. Woodward the insertion of the words "fourteen years of age or under," so that subsection 2 will read, "Notification concerning the removal of persons 14 years of age or under," and so forth.

Are you ready for the question? This is, on the substitute for Dr. Woodward's motion.

(The question was taken, and the motion was not agreed to.)

The CHAIRMAN. The motion is lost. The motion now comes on deleting the words "16 years of age or under"; that is the motion of Dr. Woodward.

(The question was taken by a rising vote, and the motion was not agreed to.)

The CHAIRMAN. The motion is lost. The question now before the conference is on the adoption of Section II as a whole. Are you ready for the question?

(The question was taken, and the section was adopted.)

The CHAIRMAN. Section III of the report reads as follows:

III. The committee disapproves quarantine by one State against another State, or quarantine by one community against another community in the same State. It is believed that the Federal Government, through the United States Public Health Service, can perform all the duties of notification and certification required in interstate relations, in case of unusual prevalence of poliomyelitis; and that State health authorities can and should perform like services as between communities in the same State during unusual prevalence of poliomyelitis.

Dr. RANKIN. I move that the section be adopted.

(The motion was seconded.)

The CHAIRMAN. Is there any discussion? Are you ready for the question?

(The question was taken, and the motion was agreed to.)

The CHAIRMAN. Section IV reads as follows:

IV. It is recommended that all cases of poliomyelitis should be reported immediately to the local health authorities and to the State health authorities, and that State health authorities make weekly reports to the United States Public Health Service of all cases of poliomyelitis. The United States Public Health Service is asked to furnish general reports weekly.

(It was moved and seconded that Sec. IV be adopted, and the question being taken, the motion was agreed to.)

The CHAIRMAN. Section V reads as follows:

V. It is recommended that all persons 16 years old or under, with a clean bill of health, and removing from an infected area or district to another locality, should be kept under medical observation daily for two weeks from the date of the certificate.

(It was moved and seconded that Sec. V be adopted, and the question being taken, the motion was agreed to.)

The CHAIRMAN. Section VI is as follows:

VI. It is believed that the period of isolation of a case of poliomyelitis should be not less than six weeks from date of onset.

Dr. SWARTS. I move that it be amended by inserting "four weeks" for "six weeks," just to get an expression from the floor.

Dr. RANKIN. As a compromise, I move to make it five weeks.

Dr. BURKART. I move the adoption of the section as read.

Dr. SWARTS. I move that the word "six" be changed to "four," so that it will read "four weeks," as between the maximum and the minimum. It is made eight weeks in New York.

Dr. GARRISON. I second that motion.

The CHAIRMAN. The motion is now on the reduction of the period of isolation from six weeks to four weeks.

(The question was taken and the motion was not agreed to.)

The CHAIRMAN. The question now is on the adoption of the section as a whole.

(The question was taken and the motion was agreed to.)

The CHAIRMAN. Section VII reads:

VII. The isolation of cases of poliomyelitis should be stringent isolation of the sick person with attendant or attendants, in a properly screened room or rooms, with disinfection, at the bedside, of all bodily excretions. Wherever it is possible, the removal of patients to a hospital is greatly to be preferred to isolation in a private house or apartment.

Dr. BURKART. I move that the section be adopted.

(The motion was seconded.)

Dr. DRAKE. I wish to know whether that section or the following section provides for the other inmates of the premises who continue to reside thereon, the adult members of the family? I think that is a very important part of this consideration.

The CHAIRMAN. Dr. Fulton, will you answer that question?

Dr. FULTON. This section does not provide for the isolation of persons. They are not specified, and therefore it does not apply to them. The committee was not undertaking to do for public health officers what they should do for themselves.

Dr. DRAKE. Then do I understand that if an adult inmate of infected premises applies for a health certificate, that health certificate may be issued to him—I mean an adult actually residing on infected premises?

Dr. FULTON. Why, no; that is very clearly covered. In every case the permit must specify the residence and——

Dr. DRAKE. I mean the adult, you understand, of course.

Dr. FULTON. Yes.

Dr. DRAKE. Then does this contemplate the quarantine of adult members of the family continuing to reside on the premises?

Dr. FULTON. I can not see that this section relates in anywise to any other person than the sick person and attendants. It is a stringent isolation. The only thing that is intended to be covered is the sick person and his attendant.

The CHAIRMAN. The chair will rule that this section relates only to the sick person or his attendant, and the question of quarantine of the other members of the household must be taken up under another section, if you wish to offer another section.

Dr. WOODWARD. Now, are we to understand that that is adopted as a principle, and that it follows that those on the premises under 16 years of age where the patient is located are perfectly safe to run around in the community at large, but are not safe for interstate travel? That is the only inference that I can draw from this section, because there is no restriction suggested, even as to children on the infected premises, except that they must not go into interstate travel.

The CHAIRMAN. Will you take that up under another section?

Dr. WOODWARD. No; but——

The CHAIRMAN. If you wish to consider the question of contact I would suggest that you take up another section regarding contact. This relates to the sick person or attendant.

Dr. WOODWARD. My purpose is to know what the committee means by this section and what its effect will be if adopted, in order that we may be guided in our future actions.

Dr. BRACKEN. If I might say a word, I would suggest that this report of the committee has relation to interstate and intrastate traffic, and not to home quarantine. It would be impossible for our com-

mittee to make regulations governing the isolation in the home of cases of anterior poliomyelitis. Many States have different rules and laws which are applicable. We are dealing now only with interstate and intrastate traffic.

Dr. WOODWARD. If I took Dr. Bracken at his word, I would move to strike this section out. I do not take him at his word, and, if I may be permitted to do so without stultifying myself, I am going to move to amend this section by adding after the word "attendants" the words "and all inmates of the infected household less than 16 years of age," as that seems to be the dead line.

Dr. FULTON. You would accomplish by that exactly the same grade of isolation for them as you do for the sick person.

Dr. WOODWARD. If they are dangerous they ought to be isolated. I will change it and move to insert those words after the word "excretions," then.

The CHAIRMAN. Is there a second to this motion? The chair hears none. The question is now on the section as a whole, Section VII.

Dr. LEAKE. In regard to the hospitalization of these cases, I should like to add a word in connection with what Dr. Albert has said concerning future treatment. You remember that yesterday Dr. Emerson emphasized that in severe cases it was not a necessity that immediate hospitalization be followed. The treatment in the acute stage recommended by those who have had the most experience is absolute rest, and meddlesome interference with the patient should not be permitted. That means that hospitalization should be carried out where it can be without injury to the patient, but that otherwise it should not be followed.

The CHAIRMAN. I think that was made very clear yesterday, and I think furthermore it says here, "is greatly to be preferred."

Dr. LEAKE. Yes.

The CHAIRMAN. So that this is broad enough not to interfere on that.

Dr. LEAKE. Simply, it is a matter of absolute rest that is required.

The CHAIRMAN. The question is on the adoption of Section VII.

(The question was taken and the motion was agreed to.)

The CHAIRMAN. Section VIII is as follows:

VIII. In case of death from poliomyelitis the funeral should be strictly private.

Dr. BURKART. I move that that section be adopted.

(The motion was seconded, and the question being taken the motion was agreed to.)

The CHAIRMAN. Section IX reads as follows:

IX. Wherever poliomyelitis is unusually prevalent, assemblages of children in public places should be prohibited.

(It was moved and seconded that the section be adopted as read, and the question being taken the motion was agreed to.)

The CHAIRMAN. Section X reads as follows:

X. During unusual prevalence of poliomyelitis schools should not be opened without thorough medical supervision by a health authority. When schools are opened, beginning should be made with high schools, and proceeding to lower age groups no more rapidly than complete medical examinations can be made.

(It was moved and seconded that the section be adopted as read, and the question being taken the motion was agreed to.)

The CHAIRMAN. Section XI reads as follows:

XI. Because of the existence of unknown carriers of the infectious virus of poliomyelitis and because the infectious virus is present in the body discharges of such persons, therefore all measures to prevent contamination by human excreta or other bodily discharges, the suppression of the fly nuisance, prohibition of the common drinking cup, and a general educational campaign for cleanliness and sanitation, with particular instruction of parents and children concerning personal hygiene, especially of the mouth and nose, are strongly urged by the committee.

(It was moved and seconded that the section be adopted, and the question being taken the motion was agreed to.)

The CHAIRMAN. Section XII reads as follows:

XII. To aid in preventing the spread of poliomyelitis, common carriers should instruct their agents and ticket sellers, by direct order, as well as by public notices, when poliomyelitis is unusually prevalent, that travelers with children of 16 years or under must be provided with a health certificate, as detailed in another section of this report.

Dr. DOWLING. What are we to understand by "unusually prevalent"? If there were 65 cases in six weeks' time would you say that was unusually prevalent?

Dr. FULTON. Yes; I would say that it was.

Dr. PARLETT. I would suggest to add the following as an amendment, "Common carriers to be notified by the Public Health Service of the area of prevalence and at what points certificates must be displayed before permitting the travel of children of 16 years or under."

The CHAIRMAN. Does the conference wish to do anything with this suggestion which Dr. Parlett has made?

Dr. FULTON. I might say to Dr. Parlett that he has furnished the committee very pertinent information. I do not know whether it can be executed at this time, but undoubtedly all of us will realize that this requirement, if imposed upon us by carriers, would put upon the health authorities the obligation to give them in all cases just exactly such notice as they require. It is obvious that the request is perfectly reasonable, and it would seem to me that the obligation is implied in the stipulations on our part. If you will accept that in lieu of a motion, I think we can let it go.

Dr. WOODWARD. I second Dr. Parlett's motion, or rather I offer the motion Dr. Parlett has suggested. I say we have provided that the Public Health Service shall investigate the infected area, so that the Public Health Service must have the knowledge in hand before it acts.

The CHAIRMAN. Is there a second to Dr. Woodward's motion?

(Dr. Woodward's motion was seconded.)

The CHAIRMAN. Dr. Woodward has moved to amend the last section of this report so that it will read:

Common carriers to be notified by the Public Health Service of the area of prevalence, and at what points certificates must be displayed before permitting the travel of children 16 years of age or under.

This imposes a pretty heavy responsibility on the service.

Dr. WOODWARD. They have got to do it anyway, though.

The CHAIRMAN. Yes.

Dr. WOODWARD. It would be the Public Health Service or the State authorities, as the case may be. If it is interstate service it would be the Public Health Service.

The CHAIRMAN. It will then read: "Common carriers to be notified of the area and prevalence of the infection, and at what points certificates must be displayed before permitting the travel of children of 16 years of age or under." Is there any discussion?

(The question being taken, the motion was agreed to.)

The CHAIRMAN. Section XIII reads as follows:

XIII. The epidemic prevalence of poliomyelitis in certain States at this time indicates a probability of epidemic prevalence next year in States not gravely affected at the present time. It is believed that the measures here recommended should be continued in operation at least until such time as the incidence of the disease has subsided to or below its usual level.

Dr. WOODWARD. Why should not these measures be continued indefinitely, and why should we limit them as to time?

Dr. FULTON. We do not.

The CHAIRMAN. It says "continued in operation at least until such time as the incidence of the disease," etc. That is not a prohibition for continuing it as long as they wish.

Dr. STILES. Would not "possibility" instead of "probability" be a more appropriate word?

Dr. FULTON. It indicates an expectation.

Dr. STILES. Expectation. That would make it like getting ready to prepare to commence.

Dr. FULTON. That is what we are doing.

The CHAIRMAN. I think "possibility" is the better word.

Dr. STILES. Or "likelihood."

Dr. FULTON. That is better yet.

The CHAIRMAN. What word shall we insert here, or shall we insert any?

Dr. SWARTS. I move that the section be adopted as read.

(The motion was seconded, and the question being taken the motion was agreed to.)

The CHAIRMAN. The question is now on the adoption of the report as a whole.

Dr. FULTON. Before any other action is taken, I should like to say a word by way of inquiry of Dr. Dowling about the words "unusual prevalence of poliomyelitis." Throughout this report the committee has rather refrained from getting into difficulties, where distinctions have to be made in matters of epidemic magnitude for which there are no criteria, but for which criteria will probably be made within a year's time. If we say an epidemic prevails, I think that includes every mode of expression; and I think it would be better than to say "unusual prevalence."

Dr. WILLIAMS. The question with the railroad people who have to carry these people is a very important one. It is illegal for the railroad to sell tickets or to refuse to carry anybody unless they present evidence of disease at the time they board the train. Now, it would be illegal at the present time for the railroads to refuse to carry people because they have not certificates.

The CHAIRMAN. I think I can answer this. The railroads come under the existing interstate quarantine regulations. They are common carriers, and if the common carrier does not observe these regulations he lays himself liable. This regulation is as follows:

SEC. 17. Common carriers shall not knowingly accept for transportation from one State or Territory or the District of Columbia into another State or Territory or the District of Columbia any person suffering from any of the diseases mentioned in section 1, except as hereinafter provided.

Poliomyelitis is one of the diseases mentioned in section 1, and there are no hereinafter provided regulations for poliomyelitis. Therefore the railroads are prohibited from carrying cases of poliomyelitis.

SEC. 18. No person knowing that he is in the communicable stage of any of the diseases enumerated in section 1 shall travel on any car, vessel, vehicle, or conveyance engaging in interstate traffic, except as hereinafter provided, nor shall any parent or guardian allow any minor, or other person under his charge who is in the communicable stage of any of such diseases, to travel in any car, vessel, vehicle, or conveyance engaging in interstate traffic.

SEC. 19. No person, firm, or corporation shall offer for shipment in interstate traffic, and no common carrier shall accept for shipment, or transport in interstate traffic, any article or thing known to have been exposed to the contagion or infection of any of the diseases enumerated in section 1, etc.

SEC. 21. Any person or thing, either living or dead, which has been exposed to or is infected with any of the diseases enumerated in section 1, if found in

any car, vessel, vehicle, or conveyance undergoing interstate transportation, shall be subjected to such inspection, disinfection, or other measures as may be necessary to prevent the spread of the infection from them.

It appears to me that the railroads must demand these certificates for their own protection, in order to keep themselves out of trouble.

Dr. GARRISON. It seems to me there is one point that has not been definitely covered, and that is with reference to the transportation of people from uninfected into infected districts. As I came to this conference quite a number of people boarded the train at Buffalo. No inspection certificate was required. Some of them came from the West. In the particular case in question the man and his wife stated they came from Kansas City, where there was no poliomyelitis. An inspector boarded the train, to the surprise of everyone, at a little town 30 miles from Buffalo and demanded a certificate. They did not have it, and 30 or 40 people were put off at a town certainly outside of the area of this infection. The train officials were anxious to know if they were liable in damages if they put these people off.

Dr. PARLETT. It seems to me this is certainly up to the health boards if they undertake to take passengers off trains, and therefore the companies are not liable for any such action.

The CHAIRMAN. The question is now on the adoption of the report as a whole.

Dr. SWARTS. I move the adoption of the report as a whole.

(The motion was seconded.)

Dr. WRIGHT. In regard to the railroads, how is a child worker, a commuter, to take advantage of the monthly commutation rate under that rule?

The CHAIRMAN. I would suggest that you take up that question after the adoption of the report. Are you ready for the question?

(The question was taken, and the report was adopted.)

The CHAIRMAN. The report is accepted, and I congratulate the conference on the very great excellence of the report it has accepted and the committee on the splendid work it has done in this regard.

Dr. SWARTS. Might I ask when we may expect a copy of these rules?

The CHAIRMAN. I think the probabilities are that they can be published immediately. Dr. Trask, do you think it would be possible for us to get this out as a special publication within the next few days?

Dr. TRASK. Yes.

Dr. WILLIAMS. Could not each delegate be provided with one in the next two hours?

The CHAIRMAN. We are making carbon copies, now.

Dr. WILLIAMS. So that if the delegates come back at 2 o'clock they can all get copies?

MISCELLANEOUS BUSINESS.

The CHAIRMAN. The program for the conference is exhausted, with the exception that we desire to give people an opportunity to speak their minds on the poliomyelitis question. The Chair will first listen to Dr. Wright.

Dr. WRIGHT. Can a ticket agent sell a monthly commutation ticket to a child worker—that is, a worker going into New York daily—under 16 years of age? There are thousands of office boys who work in New York during the summer and buy commutation tickets from New Jersey and Connecticut.

The CHAIRMAN. Dr. Banks, will you please answer that question?

Dr. BANKS. I did not quite understand it.

The CHAIRMAN. The question was, Can a railroad company sell a commutation ticket to a child under 16 years of age?

Dr. BANKS. I know no reason why not.

The CHAIRMAN. Upon the presentation of a health certificate?

Dr. BANKS. Yes.

Dr. FULTON. I understood Dr. Banks to say a few minutes ago that the conditions at that point were dealt with by certificates of health being renewed every 7 days.

Dr. COLLINS. Mr. Chairman, I now want to insist on Dr. Porter's motion of yesterday, that a common report, containing the consensus of opinion of this conference, be given us for the benefit of our people at home. Dr. Porter, you made that motion yesterday?

Dr. PORTER. I withdrew it.

The CHAIRMAN. You will all receive reports of this meeting. They will be published.

Dr. PORTER. I think we all know what the consensus of opinion is.

Dr. ROBERG. Coming back to the report blank on infantile paralysis, I would like to make a motion that a supplemental slip be attached to each report blank, giving the differential diagnosis between infantile paralysis and those diseases which may simulate it, together with other salient points deemed necessary by the Public Health Service.

Dr. WOODWARD. I second that motion.

The CHAIRMAN. It has been moved and seconded that there be attached to the report blank a statement of the salient points of the differential diagnosis of infantile paralysis. Is there any discussion?

(The question was taken and the motion was agreed to.)

The CHAIRMAN. Is there any other person who has anything he would like to say to the conference?

Dr. PARLETT. I think it would be of advantage if the Public Health Service would arrange to have a subsequent meeting with represent-

atives of the railroads, to clear up several points under discussion, with particular reference to regulation No. 22.

The CHAIRMAN. Is there any other business to come before the conference?

Dr. WOODWARD. Mr. Chairman, do I understand that this request which has just been made is for a conference of certain railroad representatives with this body?

Dr. PARLETT. Of railroad representatives with the Public Health Service.

Dr. WOODWARD. Oh, with the Public Health Service?

The CHAIRMAN. That will have to be arranged for later.

Dr. DRAKE. I think probably one of the most important things that this conference can do now is to appoint a committee for the purpose of formulating rules for the control of poliomyelitis——

The CHAIRMAN. In the home?

Dr. DRAKE. In the home, and to offer them to the various States for adoption, as a model. I make a motion to the effect that such a committee be appointed.

(The motion was seconded.)

The CHAIRMAN. You have heard the motion, that a committee be appointed for the purpose of formulating rules and regulations for the control of poliomyelitis in the home. Is there any discussion?

(The question was taken and the motion was agreed to.)

COMMITTEE APPOINTMENTS.

The CHAIRMAN. The chair will appoint as members of this committee Dr. Drake, Dr. Roberg, Dr. Garrison, Dr. Tuttle, and Dr. Collins.

Dr. BRACKEN. When will that committee report?

The CHAIRMAN. That committee will report at 2 o'clock this afternoon. The chairman will appoint as a standing committee on poliomyelitis Dr. Lavinder, Dr. Tuttle, Dr. Drake, Dr. Dowling, and Dr. Frost.

The chair will now entertain a motion to adjourn until 2 o'clock.

(At 12.40 o'clock p. m. the conference took a recess until 2 o'clock p. m.)

AFTERNOON SESSION, SECOND DAY.

(The conference was called to order at 2 o'clock p. m. by the acting chairman, Asst. Surg. Gen. W. C. Rucker.)

The CHAIRMAN. The first business to be taken up by the conference this afternoon is the receipt of the report of the committee on the prevention of the spread of poliomyelitis in the home. Dr. Drake, the chairman of the committee, is ready to make his report.

REPORT OF THE COMMITTEE ON THE PREVENTION OF THE SPREAD OF POLIOMYELITIS IN THE HOME.

Dr. DRAKE. Mr. Chairman, we have had a very short time in which to give consideration to this important question, but we have formulated what we think are the essential rules for the control of poliomyelitis. These rules are framed with full knowledge of the fact that we have very little definite scientific information of the disease. Under the circumstances we have endeavored to adopt rules which will safeguard against all avenues of infection [reading]:

1. *Reports.*—Every physician, attendant, parent, householder, or other person having knowledge of a known or suspected case of acute anterior poliomyelitis must immediately report the same to the local health authorities.

2. *Placarding.*—Whenever a case of acute anterior poliomyelitis is reported to the local health authorities, they shall affix in a conspicuous place at each outside entrance of the building, house, or flat, as the case may be, a warning card.

We do not go into detail as to the size of the card or the text.

Defacement of such placards or their removal by any other than the local health authorities or the duly authorized representative of the State board of health is strictly prohibited.

3. *Quarantine of patient.*—All cases of acute poliomyelitis must be quarantined for at least six weeks. Quarantine must not be raised, however, until the premises have been thoroughly disinfected by or under the supervision of the health officer. All persons continuing to reside on the infected premises shall be confined to the infected building, house, or apartment until quarantine has been raised, except as hereinafter provided.

No one but the necessary attendant, the physician, the health officer, and representatives of the State board of health may be permitted to enter or leave the infected premises. Upon leaving they must take all precautions necessary to prevent the spread of the disease. The nursing attendant may leave the premises only on permission granted by the local health officer.

4. *Quarantine of exposures.*—Adult members of the family may be removed from the infected premises upon permission granted by the local health officer after thorough disinfection of person and clothing.

Children of the family may be removed from the infected premises upon permission of the local health officer, after thorough disinfection of person and clothing. Such children may be removed only to premises upon which none but adults reside, and must be confined to the premises (in the house) for two weeks from date of removal, during which period they must be kept under close observation by the local health authorities, and no child shall be permitted to visit or otherwise come in contact with them during this period. They must not return to the infected premises or come in contact in any way with the patient or attendant until quarantine has been terminated.

All children who continue to reside on the infected premises must be held under close observation for at least two weeks following termination of the last case on the premises.

5. *Exclusion from the schools, etc.*—All children who continue to reside on the infected premises must be excluded from the schools and other public gatherings for at least two weeks following date of raising of quarantine.

All children who have been exposed to the disease and who have been removed from the infected premises, in accordance with the provisions of rule 4, must be excluded from the schools and from all public gatherings for at least two weeks from date of last exposure.

The patient must be excluded from the schools and all public gatherings for at least two weeks after quarantine is raised.

School teachers and other persons employed in or about a school building, who have been exposed to the disease, must be excluded from the school building and grounds for a period of two weeks following date of last exposure and until persons and clothing have been thoroughly disinfected.

Whenever the schools are closed on account of an outbreak of acute poliomyelitis, children under 16 years of age shall be excluded from Sunday schools, churches, picture shows, and all other public gatherings, and shall be confined to their own premises.

That relates only to instances where the schools are closed. Otherwise, of course, the children would be permitted to roam the streets at large.

6. *Precautions.*—No person, except the necessary attendant, the physician, and the health officer may be permitted to come into contact with the patient. Such persons must not handle or prepare food for others, and their intercourse with other members of their household must be as restricted as possible.

The infected premises, especially the sick room, shall be thoroughly screened against flies, and any such insects as may enter the sick room shall be therein exterminated.

We say "therein exterminated" in preference to driving the flies out of the premises into the open air.

All toilets used by the patient or attendants and those in which discharges from the patient are deposited must be thoroughly screened against flies and freely treated with an approved disinfectant.

7. *Removals.*—No person affected with acute anterior poliomyelitis shall be removed from the premises upon which he is found unless consent to such removal be first obtained from the local health authorities or the State board of health, and then only after strict compliance with the provisions of these rules. Under no circumstances shall permission be granted for the removal of any patient or article from the infected premises to any premises upon which milk or other foodstuffs are produced, sold, or handled.

No person affected with acute anterior poliomyelitis shall be removed from any city, village, township, or county in which he is found unless consent to such removal be first obtained from the State board of health.

8. *Sale of milk and other foodstuffs from infected premises prohibited.*—Whenever a case of acute anterior poliomyelitis shall occur on any premises where milk or other foodstuffs are either produced, handled, or sold, the sale, exchange, or distribution on such premises in any manner whatsoever, or the removal from the infected premises of milk, cream, any milk products or other foodstuffs, until the case has been terminated by removal, recovery, or death, and the premises and contents and all utensils have been thoroughly disinfected under the supervision of the local health authorities, is prohibited: *Provided,* That in the event of acute anterior poliomyelitis occurring on a dairy farm, the live stock only may be removed to some other premises and milking done and milk cared for and sold from such other premises by persons

other than those of the household of the person so affected, upon obtaining permission to do so from the local health authorities or the State board of health.

Whenever a case of acute anterior poliomyelitis shall occur on premises connected with any store, such store shall be quarantined until the case has been terminated by removal, recovery, or death, and the premises are thoroughly disinfected: *Provided, however,* That if the premises are so constructed that the part in which the case exists can be and is effectively sealed, under the supervision of the local health authorities, from the store: *And provided further,* That the employees and all other persons connected with the store do not enter the part of the premises where the case exists and do not come in contact with the patient, his attendant, or any article whatsoever from the quarantined premises, the store attached to the quarantined premises need not be closed.

9. *Delivering of milk, groceries, and other necessities.*—Milk, foodstuffs, and other necessities may be delivered at the quarantined premises, but there must be no contact between the patient or attendant and the delivery agent. Whenever practicable, milk must be delivered in bottles. When milk can not be delivered in bottles, the householder must provide a sterilized container (a freshly scalded bottle or pail) to receive the milk.

No milk bottle, basket, or any other article whatsoever may be taken out of or away from the infected premises during the period of quarantine. Before milk bottles are removed from the premises after quarantine is raised they must be sterilized under the direction of the local health authorities. Mail which has been handled by the patient or attendant must not be taken from the premises.

10. *Disinfection.*—All articles taken from the sick room must be disinfected upon removal. Exposure in the open air of carpets, rugs, curtains, bedding, and similar articles from the infected premises, for the purpose of airing, shaking, beating, or sunning, is strictly prohibited, unless, in the opinion of the local health authorities, such may be done without danger of the spread of the disease.

Books, toys, and similar articles used to amuse the patients are best disposed of by burning. Under no circumstances should borrowed toys or books be returned. Library and school books must not be returned; they must be burned.

Bed and body linen which has been in contact with the patient, and handkerchiefs or cloths which have been used to receive discharges from the patient must be immersed in an approved disinfectant before removal from the sick room, and after removal should be boiled.

All discharges from the patient must be thoroughly disinfected before removal from the sick room.

No article of clothing, or other article, may be removed from the infected premises to a laundry or other place for washing unless previously disinfected by immersion in an approved disinfectant, and the approval of the local health authorities has been obtained.

House animals such as cats, dogs, or any other household pets, and all other animals or fowls, must be strictly excluded from the infected building, house, or flat, as the case may be, during the entire period of quarantine. Any such animals which have been in contact with the patient must be subjected to a thorough disinfecting bath before removal from the infected building, house, or flat, and must not be permitted to reenter the same. Such animals must be confined in an outbuilding. Dogs and cats running at large should be destroyed.

Before quarantine is raised the infected premises and all articles of furniture and clothing therein must be thoroughly disinfected by or under the supervision

of the local health authorities in a manner approved by the State board of health.

11. *Deaths, burials, and transportation of the dead.*—When the body of any one dead from acute anterior poliomyelitis is to be transported by railroad or other common carrier the official rules of the State board of health governing the transportation of the dead must be observed.

The report is signed by C. W. Garrison, W. B. Collins, T. D. Tuttle, D. N. Roberg, and C. St. Clair Drake.

The CHAIRMAN. The conference has heard this report. What shall we do with it?

Dr. SWARTS. I move that it be received.

(The motion was seconded.)

The CHAIRMAN. It is moved and seconded that the report be received. Is there any discussion?

(The question was taken and the motion was agreed to.)

The CHAIRMAN. The question now rises on the adoption of this report. Is there a motion to that effect?

Dr. SWARTS. I move its adoption seriatim by sections.

(The motion was seconded.)

The CHAIRMAN. It is moved and seconded that the report be adopted section by section. Is there any discussion? There seems to be none, and the chairman of the committee will please read the first section.

Dr. DRAKE. The first section reads:

1. *Reports.*—Every physician, attendant, parent, householder, or other person having knowledge of a known or suspected case of acute anterior poliomyelitis must immediately report the same to the local health authorities.

Dr. RANKIN. Would it not be better to insert after the word "poliomyelitis" the words "or infantile paralysis"? There are country people who never heard of poliomyelitis.

The CHAIRMAN. Put in parentheses (infantile paralysis). Without objection, this section as amended will be adopted.

(There was no objection.)

Dr. DRAKE. Section 2 is as follows:

2. *Placarding.*—Whenever a case of acute anterior poliomyelitis is reported to the local health authorities they shall affix in a conspicuous place at each outside entrance of the building, house, or flat, as the case may be, a warning card. Defacement of such placards or their removal by any other than the local health authorities or the duly authorized representative of the State board of health is strictly prohibited.

The CHAIRMAN. I would like to ask the chairman whether his committee considered the placarding of streets. In New York where a considerable number of cases existed a large placard, reading "Poliomyelitis exists in this street," was placed at each end of the street. It seems to me a logical measure in places which are thickly inhabited.

Dr. COLLINS. Our function, as we understood it, was merely to provide for the prevention of the spread of poliomyelitis in the home.

The CHAIRMAN. Yes.

Dr. COLLINS. We confined our deliberations more particularly to the home and not to the district.

The CHAIRMAN. This committee was to consider the control for the homes and not districts.

Dr. DRAKE. That is a matter for a special ruling.

(It was moved and seconded that section 2 be adopted as read, and, the question being taken, the motion was agreed to.)

Dr. DRAKE. Section 3 is as follows:

3. *Quarantine of patient.*—All cases of acute poliomyelitis must be quarantined for at least six weeks. Quarantine must not be raised, however, until the premises have been thoroughly disinfected by or under the supervision of the health officer. All persons continuing to reside on the infected premises shall be confined to the infected building, house, or apartment until quarantine has been raised, except as hereinafter provided.

No one but the necessary attendant, the physician, the health officer, and representatives of the State board of health may be permitted to enter or leave the infected premises. Upon leaving they must take all precautions necessary to prevent the spread of the disease. The nursing attendant may leave the premises only on permission granted by the local health officer.

The CHAIRMAN. What is your pleasure as to this section? Without objection, the section will stand adopted.

Dr. BURKART. One moment.

The CHAIRMAN. There is objection.

Dr. BURKART. The objection is this: You have restricted all individuals absolutely to the house by the wording of that rule. If you say "premises" it is different. In many places some people have back yards. You say definitely "building, house, or apartment." If you say "premises" and permit persons to go in the yard, but not to mingle with others, that is different. That question comes up very frequently—whether individuals shall be confined directly to the house or have the privilege of roaming over their own premises so long as they come in contact with no visitor. Under the wording as you have it there they must remain in the building.

Dr. DRAKE. It reads, "shall be confined to the infected building, house, or apartment until quarantine has been raised." In a thickly populated community that is necessary. In a rural district it is different.

Dr. BRACKEN. I am afraid that is going to make more trouble. You have a regulation there that is extremely rigid, and I am inclined to believe that it will not be accepted. Now, what position is it going to put us in if we advise the continuance of the present regulation? We at present allow a certain amount of liberty to adults living in the house. We would allow a farmer to go on about his business, although he was living right in the house. We would

allow him even to go to town to sell his grain, but under this regulation he could not go off the premises. That is like a smallpox quarantine of 20 years ago, when we established a shotgun quarantine and absolutely stopped all traffic or communication with those who had smallpox in their house. I do not care to go back to that.

Dr. DRAKE. Of course we know little about the mode of infection of this disease. It has been pretty generally acknowledged by those who have spoken in this conference that the adult carrier is a big factor in the dissemination of the infection. If the adult carrier is a big factor in the dissemination of the infection, then the adult carrier should certainly be confined to the premises.

Dr. BURKART. The word "premises" is different from "house."

Dr. ANDREWS. If the adult carrier is to be confined to the premises, why should that adult carrier be permitted to get on a railroad train and go where he chooses?

The CHAIRMAN. I think the answer to that is that when a man is on premises where there is a known case of poliomyelitis, he occupies a very different situation than when he is going about at large. Then we have nothing by which to judge that he is a carrier. We do not know at the railroad station whether he is a carrier or not.

Dr. ANDREWS. Do you not think that it is the duty of the health officer, in the protection of the public, to ask him whether he has come from a place where there is poliomyelitis or not?

The CHAIRMAN. Yes; and that is the method of protecting the public.

Dr. ANDREWS. If he says that he has, you do not give him a certificate.

The CHAIRMAN. If he is held in the place of quarantine he can not apply for a certificate to travel.

Dr. WOODWARD. If you hold the children on the place they can not apply, either, can they?

The CHAIRMAN. The children do not all come from infected places, but this man we are supposing has come from an infected place.

Dr. ANDREWS. Suppose this man did not know the place was infected, or that he came out voluntarily from an infected place, and suppose he did know it, and the health authorities did not question him?

The CHAIRMAN. You can not stop that.

Dr. ANDREWS. But we stopped it with the children 10 years of age.

Dr. WOODWARD. I would suggest that you solve it by asking no questions about the children, and that will protect the children.

Dr. ANDREWS. Even so.

Dr. DRAKE. I think we are going beyond Dr. Burkart's suggestion by making it read that all persons continuing to reside on the

infected premises shall be confined thereto. That would leave it so they might be confined to the yard of the house.

Dr. COLLINS. Or to the farm.

Dr. DRAKE. With the permission of the committee we will make that change.

Dr. ANDREWS. If the man, then, is to be kept out of his home, I will be frank with you and state that there is not one person in the State of Alabama who will obey the regulation. You will have to have a shotgun to enforce it.

Dr. DOWLING. We have had but two instances where two cases of poliomyelitis have occurred in the same home. With a history of that kind before us, it is going to be awfully hard to enforce a quarantine. I am not going to oppose anything that can be done, but it will be very difficult to enforce a regulation of that kind.

Dr. WOODWARD. As a simple matter of fact, we acted on this matter this morning in a diametrically opposite way. I offered an amendment this morning that provided for a quarantine on the premises only of children under 16. That was adopted. Now we are reversing our action by proposing to quarantine everyone.

Dr. ANDREWS. It occurs to me that we are up against a proposition we do not know anything about, and we might just as well take the public into our confidence and inform them of that fact. From the statements made here yesterday—and they were full, free, frank, and illuminating—gentlemen of experience confessed that all their efforts toward prevention had apparently done nothing to curb this malady. Now we can not claim that these efforts have not to some extent, at least, accomplished good, for the reply might be, "Suppose that nothing had been done; we do not know what might have happened." That is all true. The disease presumably is due to a virus from the emanations of the sick, but just how it is conveyed from the sick to the well nobody knows. By our action this morning we have said that it is conveyed by children under 16 years of age, but a child 16 years and 1 day old does not tote it around with him. Now that has been said so many times it does not go any longer with the public, because they do not believe it, and it seems to me we are traveling dangerously near to ground where angels would fear to tread. I am perfectly willing to go on record as in favor of everything that will be of help in the protection of the public. That is what we are here for. It seems to me utterly absurd to put a dead line on those who are in the home and absolutely raise the dead line against the traveling public. If we are going to say that every person over 16 years of age can go where he pleases on a train we ought to say that he can do the same thing at home.

The CHAIRMAN. The chairman's opinion in this matter is that we can not afford to leave any stone unturned until the time shall come

when someone will come to us and give us definite, accurate knowledge of this disease so that we may with equal accuracy and definiteness combat it.

Dr. ANDREWS. I agree thoroughly with the chairman; but can the chair say that an adult does not have the disease any more than a child 16 years of age?

The CHAIRMAN. No; the chair does not.

Dr. ANDREWS. Then why draw the line? I merely ask, if we have no definite knowledge as to who the carrier is, why do we specify? Now, then, do you not think it would be much better to say, so far as the traveler and the people in the home are concerned, that poliomyelitis is a disease concerning which the medical profession knows practically nothing; that we are groping in the dark and are doing all we can to ascertain what is its cause and how it is disseminated; that until such time as we have more definite knowledge we recommend that the patient and all necessary attendants be strictly isolated; that all persons who have been exposed shall be kept in quarantine for a reasonable length of time—three or four weeks, or whatever it may be—after which they shall be permitted to go where they please, whether they are 16 or 160 years of age?

Dr. BURKART. Mr. Chairman, I did not expect to stir up so much commotion, but I think every gentleman here who understands the situation will agree that in rural districts confining exposed individuals to the house will work great hardship. "Premises" is entirely different. A man's premises may comprise a 40-acre farm. There is no reason why a farmer who is absolutely well should not be permitted to plow his garden or field, so long as the restrictions placed upon him as to mingling with other individuals are observed. If you confine me to my house, I must stay there; but if you confine me to my premises or my domain, that is an entirely different matter.

The CHAIRMAN. What is the pleasure of the conference regarding this subject?

Dr. DRAKE. I would say that, acting upon Dr. Burkart's suggestion, that section would read this way: "All persons continuing to reside on the infected premises shall be confined to the premises."

Dr. BURKART. The immediate premises.

Dr. DRAKE. It would read that way instead of reading as it now does, "confined to the building, house, or apartment."

Dr. ANDREWS. That is, until dismissed?

Dr. DRAKE. Yes; until dismissed.

Now, this next section relates to the release of the adult members.

Dr. DOWLING. Take a large sugar plantation, for instance; a man could roam from house to house on that plantation and still be on the premises.

Dr. DRAKE. If we were called upon to construe that as applying to the community, small town, or the city, I would say that "premises" mean the home, and it is necessary that persons should be confined to the home for the safety of a community. On the farm they might be confined to the farm. On a plantation upon which many people live, a very large farm, you might say if a person were allowed to roam at large over the entire area that the object of the regulation of the health authorities would be defeated. The word "premises" is questionable.

Dr. BANKS. I should like to say a word in relation to the attitude of the general traveling public to the regulations we have established in New York. I have found very little complaint, and there has been a more or less general acquiescence in the reasonableness of the regulations. A great many people have expressed gratification that these regulations have been established and enforced, and I think the public generally has complied with them to the fullest possible extent. They are satisfied that something is being done. I do not know that they are satisfied that everything is being done, or that the right thing is being done, but they are satisfied that we are doing something to protect them, whether it is scientifically correct or not.

Just one thought in relation to the word "premises." In New York City the situation is somewhat complicated by the fact that there are a very large number of tenement houses, and it is pretty difficult to say what a "premise" is in a tenement house or in a hotel. I think in New York City they have held that if the patient is removed from a hotel and the room disinfected, the hotel is clean.

Dr. ANDREWS. As long as the patient remains in the hotel it is regarded as infected premises.

Dr. BANKS. As long as the patient remains in the room, and it is not disinfected.

Dr. PORTER. Is the entire hotel considered to be infected premises, or just the room that the patient occupies?

Dr. BANKS. Until the patient is removed from the hotel and the room is renovated, or whatever process they go through.

Dr. PORTER. Supposing it is a disease which makes it dangerous to remove the patient to a hospital; would you quarantine the entire hotel?

Dr. BANKS. I know that they remove all cases as soon as possible, and after the process of renovation of the room the hotel is declared free from infection.

The CHAIRMAN. The question is on the adoption of this section.

(The question was taken and the section was adopted.)

Dr. DRAKE. Section 4 reads:

4. *Quarantine of exposures.*—Adult members of the household over 16 years of age may be removed from the infected premises upon permission granted by the local health officer, after thorough disinfection of persons and clothing.

Dr. DOWLING. What do you consider disinfection?

Dr. DRAKE. That is for the local health authorities to determine.

Dr. DOWLING. I wanted to know whether you meant disinfection with formaldehyde.

Dr. WOODWARD. Had we not better make that "members of the household over 16 years of age," instead of as it is, "adult members of the household"?

Dr. DRAKE. Pardon me, Doctor; it covers children. That is part of the same section. The rest of the section reads:

Children of the family may be removed from the infected premises upon permission of the local health officer, after thorough disinfection of person and clothing. Such children may be removed only to premises upon which none but adults reside and must be confined to the premises (in the house) for two weeks from date of removal, during which period they must be kept under close observation of the local health authorities, and no child shall be permitted to visit or otherwise come in contact with them during this period. They must not return to the infected premises or come in contact in any way with the patient or attendant, until quarantine has been terminated.

All children who continue to reside on the infected premises must be held under close observation for at least two weeks following termination of the last case on the premises.

Dr. ROBERG. I would amend that to read "disinfection of the clothing and a cleansing bath of the person's body."

Dr. BURKART. It reads "disinfection of person and clothing."

Dr. ROBERG. Aseptic surgery has proved that you can not disinfect the person. I do not see how you can disinfect the body.

Dr. WOODWARD. Notwithstanding the elaboration of the regulations, we draw in these regulations a distinction merely between adults and children. We have made in our other regulations a distinction between persons over and persons under 16 years of age. I think we had better draw the same distinction here.

Dr. COLLINS. We are dealing with the proposition as though those over 16 were adults.

Dr. DRAKE. May I offer the suggestion that that is merely establishing 16 years of age as the dividing line between child life and adult life?

Dr. WOODWARD. Why should we say here with respect to this distinction that we are going to apply one set of rules to those over 21 and another to those under 21, whereas everywhere else we have said we will apply one set of rules to those over 16 and another set of rules to those under 16? Why is that?

Dr. DRAKE. I think I get your point, and the reason the regulation is drawn in this particular way is this: We will admit, for the sake of avoiding argument, that the adult and the child are equally likely to be carriers of the disease; but children under 16 years of age certainly are much more susceptible to the development of the infection than are persons over 16 years of age, and the reason children are confined is because of their susceptibility to the disease.

Dr. WOODWARD. I am afraid I am particularly obtuse. There is a period between 16 years of age and 21 years of age that has in all of our other regulations been thrown into the upper age period. In these particular regulations we are throwing it into the lower age period. What is the reason for the difference?

Dr. FULTON. What is the objection to the inconsistency?

Dr. WOODWARD. It is not only inconsistency but confusion. We might just as well go through these requirements and make one regulation 16, another 17, another 13, and so on. On the basis of what other communities have done we have fixed 16 as the determining line. Now, why should we depart from that in this case?

Dr. FULTON. Why should we conform to it? In what sense is that an established practice? Where does the necessity for any statement of any sort as to age arise? Consistency in that situation would be immaterial, and I can not see any reason myself for making any alteration for the sake of consistency.

Dr. WILLIAMS. I move that instead of using the words "adult members of the family" it be made to read, "members of the family over 16 years of age." That covers the objection.

Dr. WOODWARD. Absolutely.

Dr. RANKIN. And that the change be made wherever those words occur.

The CHAIRMAN. The motion is that it be made to read, "members of the family over 16 years of age." You have heard the motion.

(The question was taken and the motion was agreed to.)

The CHAIRMAN. The question is now on the adoption of the section.

(The question was taken and the section was adopted.)

Dr. DRAKE. Section 5 reads as follows:

5. *Exclusion from the schools, etc.*—All children who continue to reside on the infected premises must be excluded from the schools and other public gatherings for at least two weeks following date of raising of quarantine.

All children who have been exposed to the disease and who have been removed from the infected premises, in accordance with the provisions of rule 4, must be excluded from the schools and from all public gatherings for at least two weeks from date of last exposure.

The patient must be excluded from the schools and all public gatherings for at least two weeks after quarantine is raised.

School-teachers and other persons employed in or about a school building who have been exposed to the disease must be excluded from the school building

and grounds for a period of two weeks following date of last exposure and until persons and clothing have been thoroughly disinfected.

Whenever the schools are closed on account of an outbreak of acute poliomyelitis, children under 16 years of age shall be excluded from Sunday schools, churches, picture shows and all other public gatherings and shall be confined to their own premises.

The CHAIRMAN. Without objection, this section will be adopted as read.

(There was no objection and the section was adopted.)

Dr. DRAKE. The next section reads:

6. *Precautions.*—No person, except the necessary attendant, the physician, and the health officer, may be permitted to come into contact with the patient. Such persons must not handle or prepare food for others and their intercourse with other members of their household must be as restricted as possible.

The infected premises, especially the sick room, shall be thoroughly screened against flies and any such insects as may enter the sick room shall be exterminated therein. All toilets used by the patient or attendants and those in which discharges from the patient are deposited must be thoroughly screened against flies and freely treated with an approved disinfectant.

The CHAIRMAN. Without objection this section will be adopted as read.

(There was no objection.)

Dr. DRAKE. The next section reads:

7. *Removals.*—No person affected with acute anterior poliomyelitis shall be removed from the premises upon which he is found unless consent to such removal be first obtained from the local health authorities or the State board of health, and then only after strict compliance with the provisions of these rules. Under no circumstances shall permission be granted for the removal of any patient or article from the infected premises to any premises upon which milk or other foodstuffs are produced, sold, or handled.

No person affected with acute anterior poliomyelitis shall be removed from any city, village, township, or county in which he is found unless consent to such removal be first obtained from the State board of health.

The CHAIRMAN. Without objection this section will be adopted as read.

(There was no objection.)

Dr. DRAKE. The next section reads:

8. *Sale of milk and other foodstuffs from infected premises prohibited.*—Whenever a case of acute anterior poliomyelitis shall occur on any premises where milk or other foodstuffs are either produced, handled, or sold, the sale, exchange, or distribution on such premises in any manner whatsoever, or the removal from the infected premises of milk, cream, any milk products, or other foodstuffs until the case has been terminated by removal, recovery, or death, and the premises and contents and all utensils have been thoroughly disinfected under the supervision of the local health authorities, is prohibited. *Provided*, That in the event of acute anterior poliomyelitis occurring on a dairy farm the live stock only may be removed to some other premises and the milking done and milk cared for and sold from such other premises by persons

other than those of the household of the person so affected, upon obtaining permission to do so from the local health authorities or the State board of health.

Whenever a case of acute anterior poliomyelitis shall occur on premises connected with any store, such store shall be quarantined until the case has been terminated by removal, recovery, or death, and the premises are thoroughly disinfected: *Provided, however,* That if the premises are so constructed that the part in which the case exists can be and is effectively sealed, under the supervision of the local health authorities, from the store: *And provided further,* That the employees and all other persons connected with the store do not enter the part of the premises where the case exists and do not come in contact with the patient, his attendant, or any article whatsoever from the quarantined premises, the store attached to the quarantined premises need not be closed.

Dr. WOODWARD. With respect to the matter of dairy farms, I would remark that the removal of the cattle does not ordinarily answer the requirements of the situation. We have had occasion to deal with somewhat similar conditions with regard to typhoid fever and scarlet fever outbreaks, and we have directed a disinfection of the utensils, bottles, and cans, so that the business might go on in the name of the owner of the original farm. It seems to me we ought to provide for that. Otherwise the regulation is really not accomplishing its purpose in the case of the retail dealer.

Dr. DRAKE. I think that could be done under the supervision of the local health authorities.

Dr. WOODWARD. Yes; and the same as to carts.

Dr. DRAKE. That is not incorporated here.

Dr. WOODWARD. I move that it be incorporated by the proper phraseology.

The CHAIRMAN. Without objection, this section will be adopted as amended by Dr. Woodward.

(There was no objection.)

Dr. DRAKE. Section 9 reads as follows:

9. *Delivering of milk, groceries, and other necessities.*—Milk, foodstuffs, and other necessities may be delivered at the quarantined premises, but there must be no contact between the patient or attendant and the delivery agent. Whenever practicable milk must be delivered in bottles. When milk can not be delivered in bottles the householder must provide a sterilized container (a freshly scalded bottle or pail) to receive the milk.

No milk bottle, basket, or any other article whatsoever may be taken out of or away from the infected premises during the period of quarantine. Before milk bottles are removed from the premises after quarantine is raised they must be sterilized under the direction of the local health authorities. Mail which has been handled by the patient or attendant must not be taken from the premises.

Dr. WOODWARD. There, again, are required to be done exactly the things that we forbid. Instead of ordering the milkman to send his bottles into the infected premises, we order him to keep them out.

Dr. DRAKE. I do not think I got that.

Dr. WOODWARD. You say that the milk must be sent into the infected premises in bottles.

Dr. DRAKE. Not necessarily.

Dr. WOODWARD. In all cases where it is possible.

Dr. DRAKE. Yes.

Dr. WOODWARD. We say that in no case shall it be done. We think it is safer to keep them out of the premises than to send them into the premises where they may be used, even by the patient—that is, notwithstanding the fact that after six weeks' accumulation of bottles they may be disinfected.

Dr. ROBERG. Does the doctor refer to the fact that they feed babies on canned milk?

Dr. YOUNG. The regulations of the State of Maine provide that the bottles shall not be carried into the sick room or home.

Dr. DRAKE. The only object in the world in providing for the milk to be delivered in bottles is to prevent the deliverer handling the bottles which have been sent out, thus infecting his hands and the balance of the milk supply.

Dr. COLLINS. In our institutions for tuberculosis we have milk delivered in bottles.

Dr. DRAKE. Of course you understand that all these bottles are to be disinfected under the direction of the health authorities before they can be removed from the premises.

Dr. WOODWARD. In the case of modified milk we would permit bottles to go in under special regulations, but I would not adopt that regulation.

Dr. DRAKE. You think it is safer the other way?

Dr. WOODWARD. Yes. Under the direction of the health officer, I would permit them to go in.

Dr. DRAKE. I have no objection to that, at all.

The CHAIRMAN. What is the pleasure of the conference? The question is whether the milk bottles shall go into the infected home.

Dr. WOODWARD. I move that they be not permitted to go in, except with a special permit from the health officer.

Dr. RANKIN. I second that motion.

The CHAIRMAN. The motion is that milk bottles be not permitted to enter the house unless under special permit of the health officer.

(The question was taken and the motion was agreed to.)

The CHAIRMAN. Without further objection, the section is adopted as amended.

Dr. DRAKE. The next section is:

10. *Disinfection.*—All articles taken from the sickroom must be disinfected upon removal. Exposure in the open air of carpets, rugs, curtains, bedding, and similar articles from the infected premises for the purpose of airing, shaking, beating, or sunning is strictly prohibited, unless, in the opinion of the local health authorities, such may be done without danger of the spread of the disease.

Books, toys, and other similar articles used to amuse the patients are best disposed of by burning. Under no circumstances should borrowed toys or books be returned; they must be burned.

Bed and body linen which has been in contact with the patient, and handkerchiefs or cloths which have been used to receive discharges from the patient must be immersed in an approved disinfectant before removal from the sick room, and after removal should be boiled.

All discharges from the patient must be thoroughly disinfected before removal from the sick room.

No article of clothing or other article may be removed from the infected premises to a laundry or other place for washing unless previously disinfected by immersion in an approved disinfectant, and the approval of the local health authorities has been obtained.

House animals, such as cats, dogs, or any other household pets, and all other animals or fowls, must be strictly excluded from the infected building, house, or flat, as the case may be, during the entire period of quarantine. Any such animals which have been in contact with the patient must be subjected to a thorough disinfecting bath before removal from the infected building, house, or flat, and must not be permitted to reenter the same. Such animals must be confined in an outbuilding. Dogs and cats running at large should be destroyed.

Before quarantine is raised the infected premises and all articles of furniture and clothing therein must be thoroughly disinfected by or under the supervision of the local health authorities in a manner approved by the State board of health.

The CHAIRMAN. Without objection, this section will be considered as adopted.

Dr. WILLIAMS. Mr. Chairman, we recently had a case of poliomyelitis develop on a farm in our State. The week before the child was taken sick it was noticed that several of the chickens were paralyzed, had staggers, and would fall over. This little patient played with one of the chickens that was apparently paralyzed, and a few days afterwards developed infantile paralysis. It has been noticed that chickens on such premises frequently have paralysis, and if we apply this regulation to dogs and cats, it is a question whether we should not take fowls into consideration. I simply mention it. I do not think it is practical, though, to kill the chickens which it might be believed were infected.

The CHAIRMAN. I think the suggestion of Dr. Williams is a very good one, and without objection this section, with Dr. Williams' amendment, will be considered as adopted.

(There was no objection.)

The CHAIRMAN. The question is now on the adoption of the report as a whole.

Dr. WOODWARD. There is a feature of prevention adopted in New York City, and possibly in Newark, and that is, forbidding the return of goods to the sending concerns—goods which have been sent on approval to recently infected premises. That may be covered.

Dr. DRAKE. Nothing can be removed from the infected premises during the period of quarantine and until after the raising of the quarantine.

The CHAIRMAN. The question is on the adoption of the report as a whole.

(The question was taken, and the report was adopted.)

The CHAIRMAN. The report of the committee is adopted, and the chairman would request that Dr. Drake dictate the report to a stenographer before he leaves the building, so that we may have an accurate record of it.

Dr. Levy, of Richmond, is with us, and desires to make a short statement regarding some observations which he has made on this disease. Dr. Levy is a very welcome guest at this conference, and the Chair takes pleasure in presenting him to you.

Dr. LEVY. Mr. Chairman and gentlemen, like the rest of you, I am mystified and puzzled by this grave disease. Certain things have suggested themselves that it seems to me have not been brought out, and at the same time are apparently of unquestioned importance, and worth following out.

In investigating an epidemic of measles, for example, it would be perfectly useless for us to start in with two or three thousand cases and attempt to find out anything about it; but starting at the beginning, we can trace the cases to a certain point beyond which we can not follow the infection in every instance. In New York City we have an epidemic, with the lines of ramification numerous, and it would seem to be almost impossible to follow them up; but a great wave is going out from New York, and it is traveling in all directions. It seems to me that these suggestions of the lines along which we may best investigate, and what we may best investigate, may be worth while, and that is my apology for asking to be heard for a few minutes.

We had reports yesterday of this epidemic spreading out from New York City, and from every State we have had reports of cases of sporadic type, so called. Dr. Williams has called my attention to the fact that the cases in Virginia are in the most isolated districts, in the mountains, and almost always well off the railroads; they are single cases, and do not spread. Now, is this the same disease as the epidemic form? If it is not the same disease, why have reports of these sporadic cases any more than to have reports of cases of scarlet fever or measles in connection with poliomyelitis? So that it seems to me that establishing the one fact, as to whether these sporadic cases are really the same disease and due to the same virus, is tremendously important. If we prove that they are not the same, that the virus is different—and I believe it can be readily established one way or the other through monkey inoculations—then we

do not need to adopt these rigid rules of quarantine in connection with isolated cases, which do not spread any way, even when nothing is done. If, on the other hand, we find that the virus is identical, then there is the question to settle, How did a single case get into a county when there has been no communication with the outside world? Once getting there, why did it not spread, when the disease appears to be so terribly infectious in New York in this epidemic?

It seems to me that this line is tremendously important, and that we should, just as soon as possible, have the necessary experiments to determine whether the virus in sporadic cases is the same as the virus of the epidemic cases, and whether we are dealing with the same disease. It appears to me that the place further to study the disease is on the edge of this advancing wave, where we undoubtedly get the epidemic form of the infection. I must confess that purely on *a priori* reasoning I can not see how this thing is a contact disease. I know it takes a great amount of bravery, and perhaps even foolhardiness, to say this; but we have the most extraordinary spread from house to house, and yet we have failure in the majority of cases, where conditions would seem to predispose to the dissemination of the infection in instances where there is kissing, fondling, and where the secretions are distributed in the greatest amount.

We were told yesterday by Dr. Frost that in 5½ per cent of the cases they could plainly trace contact, in 11 per cent contact was doubtful, and that by straining everything and counting every case where contact was possible, they could get but 22 per cent due to this cause. Then, how about the other 78 or 89 or 94½ per cent? If the infection goes from house to house, as it does, if it gets into isolated districts, as it does, and if we are dealing with a single disease, there must be some intermediate link. None of us can say whether it is insects, cats, dogs, or what not, but there must be some intermediate thing that is going to carry the infection from this house across the street, or across two back lots, and yet is not going to spread it right in the house among children who have fondled, kissed, and exchanged secretions in the most liberal manner possible. The investigation of these sporadic cases is, it seems to me, a very profitable line of research. If the sporadic cases turn out not to be the same as the epidemic cases, we do not need this rigid quarantine. If the virus is proved to be the same, then we know there must be in New York City and other places where the disease appears in epidemic type, something which is causing its spread. If it be an insect, let us say so. If it be contact, how can we explain failure to spread in the house, with rapid dissemination elsewhere? We can explain it first of all by susceptibility being uncommon. But where would we look for the greatest number of susceptible children?

Why, necessarily, among those of the same heredity; in the brothers and sisters of affected children. It would seem that some intermediate factor plays its part, and by studying these sporadic cases which do not spread and their environment, and contrasting them with and studying everything in the epidemic cases and their environment, we will be working along a fruitful line of research.

I want to thank you very much for giving me this opportunity to bring forward these points. I do not know whether they are worth anything, but to me they seem to be somewhat suggestive. [Applause.]

The CHAIRMAN. Is there any other matter to come before the conference?

Dr. WOODWARD. This might be converted into an experience meeting, but I think it would hardly be worth while putting this into the record. I have mentioned two cases which have occurred here within the last two weeks. One case occurred in one of our hotels and was probably imported from New York. It was promptly removed to the home of the attending physician, who was a relative. Some little while later a second case was reported, and inquiry showed that the mother of that patient was employed in the hotel. It was stated that she never had had occasion to visit the room of the first patient and had nothing to do with the case, being assigned to a different floor. Careful inquiry, however, disclosed the fact that on one occasion she had assisted the maid on the floor where the first patient had been in preparing the washable articles for the laundry, including those from the room of the patient. She has never shown any evidence of poliomyelitis, and up to the present time the investigations made have not disclosed that she is a carrier. Was the second patient a contact case from the New York patient?

Dr. ALBERT. In the absence of Dr. Frost, I would say, with reference to investigations of contact cases, the impression left by Dr. Levy was that in some cases only 5 and in other instances 10 to 20 per cent of the cases were contact cases. Dr. Levy asked what was the source of infection in the other larger percentage of the cases. If I remember Dr. Frost's report correctly, it was that of all of the cases of children in contact with poliomyelitis, only 5 per cent contracted the disease, or, considering some of the so-called abortive cases as suspicious, 10 to 20 per cent contracted poliomyelitis.

The CHAIRMAN. Is there any further discussion to come before the conference?

Dr. PORTER. Mr. Chairman, before the conference closes I want to offer a resolution, something on the line of that which I offered yesterday and withdrew—did not retract, as I thought I did, but withdrew—until the reports of the different committees had been sub-

mitted. We have now listened to those reports with a great deal of interest. They have been carefully prepared, and the framers are entitled to a great deal of credit for the prompt manner in which they have submitted them and the points which they have brought out. But they are rather lengthy for those who are going home to give to their people.

Mr. Chairman, while physicians, we are health officers also. The health officer and physician, while embodied in the same person, are two entirely distinct and different individuals. The health officer deals with disease so far as it is a menace to the general public, and it is his duty to protect the public. The physician is interested in the cure of disease. To the health officer it makes no difference whether the patient lives or dies, so long as the public is protected. Now, it seems to me that a concise statement of what we have done here and of our conclusions might be of some interest, and I submit the following for what it is worth:

Resolved, That it is the sense of this conference of public-health officials and of the United States Public Health Service—

1. That, although the producing cause or causes of infantile paralysis, or anterior poliomyelitis are not as yet definitely known, for in some instances individual and isolated cases of the disease do not seem to impart contagious qualities, and in other instances they have highly communicable and contagious properties, this being confusing both to the medical profession and the public, yet this conference is firmly of the opinion that infantile paralysis should be easily recognized and should be isolated and treated, either in homes or hospitals, preferably the latter, until more of the producing cause or causes are known.

2. This conference does not believe that quarantine—and by this is meant the interruption of travel—is at all necessary and discourages and frowns upon any procedure of this kind or character.

3. That it believes that supervision should be exercised over discharged travelers from known infected centers in order that they may be daily watched when arriving at points of destination, when so informed by the United States Public Health Service, and that sickness occurring among such children, of whatsoever nature, should be closely inquired into, that an early determination of the true character of the illness may be arrived at and prompt action taken to safeguard the public.

It seems to me that is the consensus of opinion, concisely put, of this conference.

(The resolution was seconded.)

The CHAIRMAN. You have all heard the resolution, and it has been seconded.

Dr. ALBERT. Did I correctly understand Dr. Porter to say that quarantine was not necessary?

Dr. PORTER. Yes, sir.

Dr. ALBERT. A little while ago we adopted regulations providing for quarantine.

Dr. PORTER. No; they provided for supervision over travel cases; quarantine, yes.

Dr. ALBERT. You have not that word in there.

Dr. PORTER. Well, it can be interposed.

Dr. BURKART. Well, it should be interposed before we vote for it. Will you read that again?

Dr. PORTER (reading):

This conference does not believe that quarantine—and by that is meant the interruption of travel—is at all necessary.

Dr. SWARTS. Leave out the word "quarantine" and put in "interruption of travel except under the rules already adopted."

Dr. MCKELVEY. I believe we all appreciate the good motives of Dr. Porter in offering this resolution, but we are mixed up enough in what we have already passed. I have voted for what has gone through as a whole, and I do not believe we want to go before the people with too many stories, conflicting resolutions, and statements. I am of the opinion that every member here will be able, when he returns home, to give his people an intelligent statement of the proceedings of this body and what has been done, and I do not believe that we want to rely upon any additional resolution at this time. Therefore I am opposed to any further resolutions of that character.

Dr. WILLIAMS. Mr. Chairman, it seems to me I can not agree with Dr. McKelvey, because much has been said that is pretty definite. It has been stated that the infectious virus is in the secretions of the nose and the mouth and in the intestinal secretions. That is a big point. As to the various means of this transfer from one person to another, that has not been so thoroughly determined. We know that 90 per cent of the cases have been in children under 10, 5 per cent between 10 and 16, and the other 5 per cent above that age. We have pretty definite directions based on this knowledge, and it seems to me that we can just give to the press these committee reports, the three which have been approved, and that that will be sufficient. If any State health officer wants to abstract these or make a press report based upon them he is at liberty to do so, but it seems to me that the resolution which has been read by Dr. Porter will very decidedly cause confusion, especially after the definite reports which have been submitted.

The CHAIRMAN. Is there further discussion of this resolution?

Dr. PORTER. Mr. Chairman, there is no desire on my part to thrust anything for further consideration on this conference, but I do know that these reports that have been submitted on interstate communication and supervision of travel and the care of the individual patient are too voluminous to be gotten into the public press and before the people, who are already confused on this subject. I have

merely attempted to put into concrete form what has been arrived at in the discussion.

Dr. COLLINS. A question for information, if you please. These reports will all be summed up in the bulletin? I understand that to be the case.

The CHAIRMAN. They will all be published in book form.

Dr. COLLINS. I mean as a whole?

The CHAIRMAN. The entire report of this conference will be published; the remarks of all you gentlemen, and everything connected therewith.

Dr. PORTER. That is all true, that these reports will be published and that health officers will receive them, but the general public of this country will not get them. They do not see them unless they write here and through the courtesy of this bureau are furnished a copy.

The CHAIRMAN. I will say, for the benefit of the conference, that we have not been without newspaper men since we started, and the newspaper men have kept pretty close track of what has gone on here, and have published fairly accurate articles on what has happened.

Dr. RANKIN. The reason I have not enthusiastically seconded my friend's resolution here is because I am going home to publish my own statement, and I am afraid that my report might not altogether agree with that. I am going to tell the folks that we do not know a "blooming thing" about it, and I am going to tell them that there is a greater incidence now in the cities, with all of your control, than there has been in the cities in the past, with no efforts toward control. I am going to tell them that the present methods are worthless. Now, if the conference wants to go down into North Carolina and give the folks there the idea that something can be done, all right; that is, you folks are going to give them the idea that you can do something, when as a matter of fact you can not do anything, and you know it.

Dr. PORTER. No; I beg your pardon, Doctor, I did not say that in the resolution. I only say there what we should do; and I think there should be some supervision over child travel. Now, whether it is done by the Public Health Service or by the individual States I do not know. In my own State—I can speak authoritatively on that subject—we examine all people coming in on through trains and on steamboats from northern points. We do not interrupt travel, but we exercise supervision over child travelers, and the municipal authorities are notified so that they can continue the observation and inform the executive officers of the State board of health if anything unusual happens. Now, I think that is about all that we can do.

Dr. BURKART. I call for the question.

The CHAIRMAN. The question is on the adoption of Dr. Porter's resolution.

(The question was taken and the resolution was not agreed to.)

The CHAIRMAN. The noes seem to have it; the noes have it and the resolution is lost.

Dr. WOODWARD. Mr. Chairman, there has been great benefit to those present by these interstate regulations being so promptly mimeographed and distributed. I wonder if it would not be possible to have those on local quarantine prepared and mailed, perhaps, to-morrow.

The CHAIRMAN. That will be done. I have asked Dr. Drake to dictate them immediately to a stenographer, and to-morrow morning they will be gotten out and mailed.

Dr. RANKIN. That will include also the forms that Dr. Lavinder and others have formulated?

The CHAIRMAN. Yes. Is there any further business to come before the conference? If not, a motion to adjourn will be in order.

Dr. BURKART. I move that we adjourn.

(The motion was seconded, and at 4 o'clock p. m. the conference adjourned.)

○

FROM
CONGRESSMAN W. H. CARTER

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 84
DECEMBER, 1916

IS MOSQUITO OR MAN THE WINTER CARRIER OF MALARIA ORGANISMS?

By

M. BRUIN MITZMAIN
Technical Assistant, United States Public Health Service

PREPARED BY DIRECTION OF THE SURGEON GENERAL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1916

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
10 CENTS PER COPY

ILLUSTRATIONS.

FIG. 1. Map showing individual plantations of the Mississippi Delta Planting Co.

2. Upturned root mass of fallen tree where a few specimens of *A. quadrimaculatus* were found amongst the exposed root fibers on March 28.

3. Excavation made by falling tree exposing roots, pool of water beneath. Here, in February and March, culicines were found in larval and pupal stages and emergences observed. *Anopheles* absent.

4, 5. Method of searching hollows in standing and fallen timber for hibernating forms. The tree shown in figure 5 was seen to harbor many *Anopheles* in September, 1914.

6. A hole in a hollow tree receiving sulphur dioxide fumigation.

7. Showing understructure of plantation houses, which are found to be fruitful sources of hibernating *Anopheles*.

8. Showing understructure of plantation houses, which were found to be fruitful sources of hibernating *Anopheles*.

9. Dr. M.'s house, showing means of access by mosquitoes through lattice work and holes in brick understructure. Under this house the first hibernating *Anopheles* were collected during the first week of February.

10. Typical cypress trunk with fissured structure in which leaves found lodgment to serve as possible hiding places for resting anophelines. Such places were not found to shelter mosquitoes.

11. Canvas-covered canoe, which remained undisturbed during fall and winter. Shows the ripped canvas in the end of the canoe where several inches of water remained. No mosquitoes of any stage were seen.

12. Showing the method adopted by use of horses as bait to attract anophelines in the woods.

13. An inundated "borrow pit" on Whitehall plantation. *Anopheles* larvæ were not found here during February.

14. Junction of Deer Creek and Lake Bolivar, where in late fall larvæ and pupæ of *A. quadrimaculatus* were found. Seven persons among the fishing women on the bridge proved to be winter carriers of *Plasmodium*.

15. Group of negro tenants on Lake Vista plantation. No case of sickness reported here, yet 43 per cent were carriers of malaria during February and March.

16. Group of tenants on Myers plantation. 50 per cent were infected with malaria during February and March. No clinical case observed. The head of the family proved to be a gamete carrier.

17. Showing apparently healthy negro tenants of Mound plantation engaged in clearing operations. Five of the eight men in this picture were winter carriers of malaria; two of these harbored gametocytes.

18. Photomicrograph of a stained preparation showing young oocysts on the stomach of an *A. quadrimaculatus* dissected May 15, 1915. This represents the initial infection of the spring season.

19. Enlarged view of portion of figure 1.

IS MOSQUITO OR MAN THE WINTER CARRIER OF MALARIA ORGANISMS?

By M. Bruin Mitzmain, Technical Assistant, United States Public Health Service.

The potential hosts, mosquito and man, were studied to determine the carrier responsible for the perpetuation of the malaria organism during the inactive period of winter. An effort was made to show where the causative agent of malaria remains latent in localities having a dormant season, during which the anopheline mosquitoes hibernate. The results of this study are given herewith. The solution of the problem is aimed at because its economic importance appears to be not inconsiderable, judging from the discussion devoted to it by many writers on malaria epidemiology.

LITERATURE.

The available references in the literature on this problem of hibernation are as follows:

Herms (1915) has given probably the best exposition of the relationship of man and mosquito in regard to the question, "How does the malaria parasite overwinter?" He is quoted as follows:

"Since malaria has a typical seasonal occurrence, with little or no appearance during the winter months, the question arises, Does the parasite overwinter in its human host to break out in the spring in individual cases by the process of parthenogenesis, or does it overwinter in the body of the mosquito? The weight of evidence is against the latter possibility. The writer believes that the *Anopheles* mosquito seldom or ever takes a suck of blood before going into hibernation. A suck of blood would militate against the life of the mosquito inasmuch as it causes the development and ultimate extrusion of ova and that terminates the life of the insect. Other physiological reasons, involving further increased metabolism, seem to discount the possibility of successful hibernation. Furthermore, the writer has seen great numbers of voracious *Anopheles* in the spring both indoors and out, and has been frequently bitten by these as have many others without becoming infected. These hibernated individuals on coming out early in the spring bite viciously even at noonday. Furthermore, evidence that infected mosquitoes exist during the winter months seems to be lacking or has been overlooked.

"On the other hand, latent human infection has been amply proved, and this may easily lead to the infection of the mosquitoes appearing in the early spring and thus lead to the spread of malaria as the season advances."

Evidently, there is some disagreement among certain authors in accounting for the recrudescence of malaria during the winter.

Stephens (1908) states that the recurrence of isolated cases of new infections with malaria in Italy during winter and spring is attributed to the agency of the hibernating anophelines. In the early months some of these may fly abroad, as early as February on warm days, and further, as Koch pointed out, in certain houses where *Anopheles* exist the temperature is high enough to allow the development of the parasite in the mosquito. "One fact, however, has not been established, that these hibernating anophelines actually do contain sporozoites in their salivary glands; and in fact, according to Schoo, of Holland, they do not. MacDonald's observations in Spain were also negative in this respect."

Manson (1901), with his usual insight, sums up his knowledge of the problem in stating that in countries in which there is a cold season, during which fresh malarial infections do not take place, the infection of the next warm season is probably, in most instances, started from a relapse of a previous infection. "It has not been shown that the malarial parasite can retain its vitality in the mosquito during the hibernation of this insect."

And again Manson (1914) explains the improbability of sporogonic cycle under circumstances of hibernation by the statement that one of the most important conditions necessary to the sporogonic phase of the malaria germ is a sustained average temperature of at least 60° F. "The malaria parasite will not develop in the mosquito at low temperatures."

Deaderick (1911) expresses his views as follows: "How is the existence of the malaria parasite perpetuated? Why does the disease become extinct over winter when there are apparently no mosquitoes to further the life history of the organism?" He believes that it is possible that in a few instances the parasites persist in the bodies of hibernating mosquitoes. "While some investigators have led to a different conclusion Martirano found in the neighborhood of Rome, as late as the middle of March, that from one-fifth of 1 per cent of *Anopheles* were infected." Deaderick concludes that latent or chronic malaria will furnish the solution.

Henson (1913), writing of the limitation of the rôle of wintering *Anopheles*, states that, relative to climatic conditions, it has already been shown that in many sections of the world following the winter months malaria has been eradicated, and that before mosquitoes are again capable of producing the infection in man it is necessary for them to feed on the blood of infected man—that is, blood containing the sexual forms of the parasite.

Mitchell (1907), on the authority of Dr. Johnson, believes that the malaria parasites have their winter quarters in the human body, because the female mosquitoes do not make a meal before hibernating. These, however, quoting Dr. Smith, may bite during the winter in a warm house.

Smith (1904) describes the conditions applicable to the State of New Jersey as follows: "Breeding of *Anopheles* goes on until November in mild season, but early in October, or even in late September, specimens begin to seek hibernating quarters. As the insects do not feed before doing this, the malarial organism can not be carried over by them. The germ lies dormant in the human blood, and, in a partly cured case, there may be no active symptoms of the disease, while yet the gametes or reproductive bodies are present. Such cases as these Italian laborers have started malarial trouble in several New Jersey localities theretofore exempt."

Scheube (1902) summarizes the views of several authors relative to hibernation as follows: "It therefore follows that the same kind of mosquito may be

harmless at a low temperature but may become dangerous when the temperature rises. The mosquitoes in zones of moderate heat are driven into houses, huts, stables, etc., during the winter, and the parasites then perish. In the spring, however, the mosquitoes reinfect themselves from patients who are suffering from relapses, which, thus as it were, form the connecting link, the bridge between the fever time of one year and that of the next."

Scheube states that Celli and Del Peno found in the Campagna that the fevers of March to the end of June were relapses of former infections; that toward the end of June, the first infected *Anopheles* were found, and their number increased in July and August.

The foremost American sanitarians regard the question of continuance of infection by means of hibernating mosquitoes as unsettled.

Von Ezdorf (1915) writes as follows: "Mosquitoes do not bite, and are inactive when a temperature of 15.5° C. or less is reached. At this or lower temperature the mosquitoes begin to hibernate, finding protection in garrets, under houses, in hollows of trees, etc., but if the weather should moderate and become quite warm, as happens in our southern States, the mosquitoes may again become active; it is known that endemic outbreaks of malaria have occurred in the winter months, but whether due to infected hibernating mosquitoes or to relapses is not known. It has not yet been definitely determined whether the infected hibernating mosquito carries over the infection from winter until spring.

"In the winter months cases of malaria which occur are usually relapses from previous infections. The influence of cold in these relapses produces a lowering of the vitality in the individuals, and thus favors the renewed invasion of the parasite."

Craig (1909) is quoted as follows: "In temperate and cold regions they may pass through the cold season as fully developed adults, as larvæ, or even in the ova. According to Theobald, the fertilized females of *A. maculipennis* hibernate in the adult stage in cellars, outhouses, stables, etc., while *A. bifurcatus* and *A. nigripes* exist throughout the winter in the larval stage even under thick ice. If a warm spell occurs during a winter some of the hibernating mosquitoes emerge from their hiding places and bite, thus causing outbreaks of malaria during the winter season."

Regarding the hibernation of the various stages of *Anopheles* in a restricted biological sense, a review of the literature is given as follows:

Patten and Cragg (1913), alluding to the longevity and perpetuation of the anophelines, state that the commonest method by which this is brought about is by the hibernation of impregnated females, which, finding the season too far advanced to complete the maturation and deposition of their ova, seek out resting places and remain concealed until favorable conditions present themselves at the commencement of the next season.

Nuttall and Shipley (1901) cite that *A. quadrimaculatus* is recorded by Grassi as congregating during the winter in houses, huts, and barns in southern and central Italy. Only the imagines are found and no larvæ. The larvæ of *A. bifurcatus* were found in these localities. Grassi assumed that these latter may not have hibernated but were derived from late-laid eggs.

Nuttall and Shipley, commenting on their own work, state that in laboratory experiments in England larvæ collected in summer were allowed to develop; that, while those of *A. bifurcatus* remained alive during the winter, all the larvæ of *A. quadrimaculatus* died. They remark that "whether the larvæ of *A. quadrimaculatus* are capable of hibernating or not can not be positively stated, although it would appear unlikely, judging from our observations and those of Grassi."

Nuttall found that *A. quadrimaculatus*, which hibernated in the winter in Cambridge, was observed to disappear in May, "no doubt to oviposit and then to die."

Grassi (in Nuttall and Shipley, 1902) says that he has never found the males of *A. maculipennis* hibernating but only the females, all of these being fecundated. They begin to disappear in February, in Italy, and vanish to a greater extent in March when at times none are to be found. These insects have, presumably, flown out and died after depositing their eggs.

Austen (1901) cites his observations in England as follows: "In colder climates, on the other hand, impregnated females survive the winter in some suitable retreat in a state of hibernation, during which they take no food, depositing their eggs at the commencement of warmer weather."

Annett and Dutton (1901) in the course of their observations on the hibernation of English mosquitoes never found any of the mosquitoes in stables and cattle sheds, as these places were comparatively dry and warmed by the animals at night. Not a single male *A. maculipennis* was seen during several months in the winter. This fact they interpret as indicating that it is the female alone that hibernates.

Stephens (1908), writing on the length of *Anopheles* life, states: "It was originally supposed that mosquitoes, when they had laid their eggs, died. The observations are, however, probably true of these mosquitoes which have hibernated during the winter (in a fecundated state). On the return of spring they sally forth and lay their eggs and die."

Stephens assumed that the hibernating *Anopheles* are all females and these are always fertilized; that the females, if roused from their sluggishness by bringing them into a warm room, will feed, and after a time lay eggs; if, however, the temperature be kept low, they do not arouse themselves and do not feed.

Giles (1902), referring to the seasonal inactivity of *Anopheles*, states that this habit is spoken of as hibernation, and in Europe, where the males apparently all die before winter has fairly set in, only impregnated females survive the winter, "and it is through their agency alone that the continuity of the species is maintained."

Howard, Dyar, and Knab (1912), are quoted as follows: "With the majority of the species of mosquitoes the unfavorable season is passed in the egg state. Certain genera, however, pass the winter in the adult state. In such cases it is only the female that survives, having been previously fertilized, to deposit her eggs at the beginning of another season. It is certain that, at least in the genera *Culex* and *Anopheles*, no males survive the winter. The hibernating females seek shelter with the approach of cold weather, and at this time they show no inclination to feed. Those species more or less associated with man take advantage of the shelter of cellars, stables, sheds, and other outbuildings, the darkest ones apparently being the most favored. They have also been found hibernating in caves. Other species retire to hollows in trees, crevices in the bark, or other protected situations. There they remain quiescent until the return of the warm weather, closely hugging the surface upon which they rest."

Rosenau (1913) remarks: "The way in which mosquitoes manage to pass through the rigors of the winter probably varies with the different species. Some, like the malarial *Anopheles*, hide in sheltered cellars or dark nooks, or hibernate in other out-of-the-way places. Other species survive through the power of the larva or egg to resist cold, for the larvæ or eggs of some species will hatch even after they have been frozen."

Shipley (1915), writing of the eggs of the *A. quadrimaculatus*, states: "There is no evidence that they can survive throughout the winter period. Everything that we know indicates that the egg must pass the period within the mother's body, and that they only attain maturity in early spring, when the weather becomes warmer."

It will be noted that there is a marked unanimity of expression indicating the belief that the mosquito phase of the overwintering of malaria is a negligible factor. These opinions are, to be sure, based on epidemiological data and show a uniform absence of experimental proof. However logical these expressions appear to be, the fact remains that the problem can not be dismissed as settled until further experimental data are presented.

OUTLINE OF WORK.

At the outset of the present work it was necessary to secure data contributing toward the solution of the following: In what habitat in the region under observation did anopheline mosquitoes hibernate? When did this occur, and under what limitations? In what form (egg, larva, pupa, or adult) did anopheline mosquitoes pass the winter? What were the effects of temperature on the activities of the hibernating mosquitoes? Lastly, did anopheline mosquitoes harbor any form of the malaria organism during the dormant stage?

A persistent effort was made, during February to June, 1915, to collect as much data concerning these points as was possible.

A district comprising 15 plantations of the Mississippi Delta Planting Co., in Bolivar and Washington Counties of northwestern Mississippi, was selected for the purpose of this study by Surg. R. H. von Ezdorf, in charge of malaria investigations of the Public Health Service until his death in September, 1916.

In a general way the places inspected were those known to have harbored *Anopheles* mosquitoes during the season when malaria was prevalent. The plantations selected for domiciliary visits were the most heavily infected of the 15 plantations, the malaria index registering, at one place at least, as high as 58 per cent in September, 1914. The following record gives the details as to the character of the places visited and the opportunities for infestation presented. Routine inspections were conducted in this manner for a period of six weeks, beginning February 5, 1915. During the first two weeks the writer had the cooperation of Sanitary Engineer Le Prince, who was assigned to field studies. His notes are incorporated in the account appended.

NOTES ON FIELD EXAMINATIONS.

February 5, 1915.—Examined interior of buildings and outhouses connected with Dr. M.'s residence. They included ice house and harness room, which were very dark and tight (wind proof), but accessible to mosquitoes. The former

was found with one opening, about 6 by 2 feet, partially protected by a torn screen about 5 feet from the ground, one entry door, always closed when not in use. Ice house contained cotton sacks, boards leaning against the wall, and empty boxes and barrels. The harness room was well constructed (size 4 by 6 by 10 feet), wind proof, but would admit mosquitoes at all times. We examined the stable, containing cotton sacks, boards, exposed shingle roof, cornstalks used as bedding for stock, underside of feed trough in mangers, high and low rafters, and ceiling of shingles above them.

One old abandoned barn east of Dr. M's house contained a flat-bottomed boat and wooden canoe with canvas compartments. The floor of this structure was covered with cornstalks about one to two inches deep; it was not used except for storage of unserviceable waste and such odds and ends as old stoves, tin cans, large and small bottles, loose wire screen, boxes, worn-out stovepipe, and two baby carriages. These were stacked in a disorderly heap in the corner of the building in a pile about 8 by 8 by 4 feet high and offered many excellent hiding places for mosquitoes. The flat-bottom boat had the rear seat boxed in for a length of 2 feet; a board of this box was torn off, so that its inside compartments might be carefully inspected—results negative. The canoe was interesting and offered excellent wind shelter for mosquitoes. We ripped open the canvas compartments and took a photograph of the boat. While this was being done, it was noted that water 6 inches in depth filled the lower end. The stored canoe was resting at about 30° to the horizontal, so that water collected at the pointed end of one of the compartments. Anopheline larvæ were absent.

About a quarter of a mile from the house we examined the grove of trees surrounded by cotton fields. We examined the interior of six large hollow trees—one was 4 feet wide inside—also the interior of 15 hollow logs and 22 live trees with big vines growing on them. The trees were buttressed at the trunk, offering excellent wind shelter. The vines had diameters up to 2 inches and many hairy roots to grasp the tree's bark and would afford an insect much protection. One oak tree had hollows in upper portion of roots and they were examined by striking matches and illuminating the interior.

Next, examined negro cabin—back, inclosed porch with lots of stuff stored, including parts of wooden bed which were leaning up in a corner, and cracks between logs of back wall of house inside of balcony—then examined corn storage shed with wooden shingle roof. Results negative.

February 6.—Examined the premises of plantation manager, Mr. R. L. The residence was inspected within and under, and the near-by barn was likewise inspected. It was noted that a leafy vine, suitable for mosquito harborage, covered the sides and roof of the main building. Two large animal sheds with moss-covered roofs were examined. A small bell tower near cow barn also received attention. The inspection included a near-by cotton gin and warehouses. Mosquitoes were absent generally.

February 7.—Spent the entire day in wood and cypress and oak swamp near Dr. M's estate. At the present time the swamp is being drained and the woods cleared. During the summer of 1914, a moderate number of *Anopheles* larvæ were collected in this swamp. We inspected the contents and surroundings of 72 cypress and oak trees and stumps with loose bark and worm-eaten interiors, many partly hollow and in a state of collapse. These were torn apart for more careful examination, as they offered numerous excellent hiding places for mosquitoes. We found piles of leaves in some instances heaped to the trunks and crotches and covering fallen logs. These were examined minutely. The loose bark on cypress stumps was observed to be so placed as to afford excellent shelter from rain, sun, and wind. A special effort was made to ascertain the

presence of hibernating mosquitoes in this seemingly favorable environment, but all search was fruitless, although 17 harborages of this nature were carefully scanned. In many of the cut trees the roots were submerged in a natural basin of water, suppyling moisture to about one-third the length of the interior of the hollow stump. In other stumps, decomposing in the interior, the tops were found to be open so that the interior of the tree stump formed a natural tube to which the rain had access. In still others, which were hollow to a considerable distance, they were entirely protected from the rain and moistened only from rain-soaked soil at the roots. Many stumps, seemingly sound externally with solid bark, were rotted in the interior, and had numerous channels made by burrowing insects, and holes made by owls, woodpeckers, and rabbits, thus seeming to furnish conditions attractive to resting mosquitoes. In many of these the entire bark was cautiously stripped to expose the interior, when the holes and air spaces were minutely inspected. Other trees were carefully inspected for mosquito infestation; some old trees with hollows exposed to the wind found isolated in cotton and corn fields, as well as trees and stumps in the interior and on the edges of the swamp; also the tree stumps and trees in the heart of the dry woods. The hollows of some of these trees extended into the roots, the spaces of which were prodded with sticks. Also 22 fallen trees had their bark removed, and the surrounding accumulation of leaves and wood pulp were well scrutinized. No mosquitoes were seen in these natural environments, though they were apparently suitable resting places, and indeed, in several of the places inspected, mosquitoes had been found previously during the time of mosquito activity.

February 8.—It was noted that as late as 7.30 a. m. there was a coating of one-eighth to one-fourth inch of ice in the road side ditches.

Inspected the environs of a large frame building, fitted up as a general store and post office. The interior, which was dark in the early morning, was seen by the aid of an electric flash light and an oil lantern. Here numerous situations, ordinarily favorable to mosquitoes, were encountered. The building was unusually dark at all times, the only sources of light being obstructed by broken shutters fastened securely. The ordinary accumulation of empty barrels and boxes glutted the available storage space. Several of these were superimposed, so that the lower as well as the upper one was accessible to mosquitoes. Empty sacks in the corners and loose boards leaning against the wall, as well as a large empty piano packing case, were inspected. The vacant spaces, on 36 feet lengths of shelving and under the numerous counters, were examined carefully, with negative results. An adjoining wreck of an abandoned barn, once utilized as a blacksmith shop, but now inhabited by a family of swine, was given careful consideration, with no better results.

Following this the interiors of nine negro cabins were examined. All of the inhabitants agreed that mosquitoes were not found in their houses during the cold season. These persons were offered 25 cents for each mosquito found during our visit and subsequently, but without return. We inspected the cracks in these log houses, under shelving, under loose wall paper, the wooden ceiling, and sacking suspended therefrom, also furniture, beds, and loose boxes littered about the floors. The inspection included the underside of these houses. No mosquitoes were found.

February 9.—Ice about 8 a. m., melted by 9 a. m., warm at noon—about 14.5° C. to 15.5° C. in shade.

Caught the first mosquito since arrival. Several (9) captured in short time under the house of Dr. M. at 2 to 2.35 p. m. Captured six on north side of house, some flying away at our approach and settling again near by; two

of these escaped by flying away from the house. Two mosquitoes were captured on strands of cobweb. One was taken while resting on brick support. The remainder were collected from surface of wood, usually near a moist place.

Inspected Eastland estate, 2 miles north of Scott. Under the manager's residence the entire flooring was inspected. In this particular locality in September, 1914, Mr. Le Prince had counted as many as 30 *Anopheles* to the meter. Two chimney supports under the house were likewise inspected, but no mosquitoes were found. The several outhouses, horse shed, and hay loft yielded nothing. Four hollow trees were examined; two were subjected to sulphur dioxide fumigation. This was done by spreading white paper over the ground inside of the tree; bricks were placed on this supporting an iron pot containing sulphur and alcohol. Stiff paper, held in place by boards, effectively covered the opening. The hollow in these trees extended fully 15 feet, so that it was necessary to apply the sulphur fumes for a long period. After several hours the pot was withdrawn and paper and interior of tree were inspected, but no mosquitoes were found. The only living things seen were six small, stupified flies, collected from the layer of paper.

February 10.—Inspected a large number of houses on Belmont plantation. Several *Anopheles* were taken in the bright light under the plantation manager's house; most of these were seen on the flooring near the walls.

The first general mosquito infestation was noticed on February 11, beginning at 4.30 p. m., in the woods of Mound plantation. Here, while making an inspection trip with three other horsemen, *Anopheles* were observed biting our horses, particularly on the sides exposed to direct sunlight. It was noted that the flight was from northeast; that there was a moderate breeze from the southwest; and that the nearest settlement, comprising 45 dwellings, lay approximately three-eighths of a mile to the west, the direction apparently selected by the voracious mosquitoes.

Large numbers of mosquitoes were observed to be coming from the general direction of the depth of the woods, where the company's main drainage ditch was located. Prior to this time, and subsequently, at least once weekly for a period of three months, this body of water was scrupulously explored for any young forms of *Anopheles*. Immediately following the general infestation, a special and conscientious effort was made to locate empty puparia, to account for the emergence of such a swarm of mosquitoes. Absence of these or other young forms was invariably the rule.

On the following day, February 13, mosquitoes were still present in considerable numbers, but few were found a month thereafter. In fact, a relatively warm day was required to induce biting, although horses were used to bait the mosquitoes. Between March 6–13, only 14 *Anopheles* were collected from two plantations, but the two following days proved to be warmer, when 69 specimens were collected from a horse used for the purpose. Biting the horse did not begin usually until nearly 3 p. m. upon these and several other occasions. The mosquitoes were seen to come from the direction of the near-by

swamp, attacking the horse on the side away from the swamp, biting in the sunlight.

It appears that some resting place other than under dwellings must be offered, to account for the hibernation of the swarms of anophelines which infest this locality during warm days in winter and in early spring. Several of these sites were actually devoid of resting mosquitoes, although the residents complained of them during warm spells. A notable example of this paucity of material was found in a residence inspected at Nugent plantation, about 4 miles north of Scott. Here the manager's residence, a commodious, substantially constructed, frame house, was examined on February 18. The house was situated about 50 meters from some swamp land, which was formed by the overflow of Lake Bolivar. The structure presented a floor space of fully 486 square feet of solid boarding. The height from the ground was 2 feet 6 inches, surrounded on all sides but one by latticework forming holes 1¾ inches in size. The remaining side was made of an unbroken brick wall. The supports, numbering 59, consisted of brick bases, with 5 additional brick bases supporting the fireplaces above. Five wooden stairways must also be mentioned, as ordinarily these shelter mosquitoes. At the time of examination the ground beneath the house was fairly dry, but covered with tin cans and dried leaves. Under the dwelling there was ample light to see the boarding surface and brick supports. No mosquitoes were found in any of these places. The swamp in front of the house was devoid of young mosquito life.

In this region the nearest approach to a house cellar was found, February 16, in the form of a dirt storm cellar, built alongside the residence adjoining an old ground cistern. Here no mosquitoes were found, although seemingly ideal shelter was offered. This is significant, because various authors state that house cellars offer good locations for hibernation.

Some clue as to the resting places of anophelines during early spring was afforded on the morning of March 28, while I was in the oak woods examining the upturned roots of a fallen tree. A few mosquitoes were noticed flying about in the light, one of which, an *A. quadrimaculatus*, was caught biting my hand. It was examined subsequently and proved to be negative for suspicious organisms. Several of the active mosquitoes alighted on the moist root hairs of the dead tree. A bird dog was induced to nose about the holes in the matted roots, with the result that it attracted the attention of several vicious *A. quadrimaculatus*. It was noticed that a small pool was formed in the excavated earth under the root mass, and here a moderate number of culicine larvæ were collected. Neither eggs nor larvæ of *Anopheles* were present.

Again, earlier in March while in the interior of the woods exposing myself to the attacks of *Anopheles*, I dislodged some mosquitoes from a young cypress tree. Upon closer examination I observed an *A. quadrimaculatus* female resting among the twigs. For several hours I repeated this experiment, vigorously shaking young trees in the cypress brake, and counted several mosquitoes, apparently anophelines, which were dislodged from their resting places. On the two following afternoons I brought a saddle horse to an open place near the cypress brake and in 30 minutes succeeded in collecting 24 *Anopheles* that alighted on the horse.

The evidence offered from the investigation thus far would seem to indicate that the majority of the mosquitoes captured probably hibernated in the denser portion of the woods. Here, protection from unfavorable conditions of temperature, winds, and moisture would be better assured. Doubtless, with suitable rise of temperature, anophelines become active, biting men and horses in the woods, being transported in a measure by these natural vehicles out of the woods to the near-by dwellings. Here they would again seek shelter, selecting the most suitable substitute for trees, namely, the large timbers under the flooring of the house, where moisture, darkness, and wind protection could be obtained. Here, upon the understructures, the anophelines were discovered in a quiescent state, the degree of dormancy depending on the time of day and the temperature. By the aid of the electric torchlight, these mosquitoes were studied under many houses, beginning early in the morning and throughout the day. From a dormant, sprawling condition in the cold forenoons, a gradual change of attitude and location was noted. Incidentally it was observed that the well-known attitude of "sprawling" was rarely assumed when the temperature was above 9.0° C. The usual attitude of the two species, *A. quadrimaculatus* and *A. punctipennis*, under the dwelling was seen to be with the body held nearly parallel to the perpendicular plane, close to the flooring with the head directed upward and the caudal end slightly raised. When the weather became slightly warmer, or when disturbed from the normal attitude, the mosquitoes were found suspended from above, nearly at right angles to the flooring.

A perceptible shifting toward the warmer and lighter side of the house was observed as the morning progressed. By remaining quiet for 30 minutes or longer, the observer was aware that the mosquitoes shifted from the understructures to the open spaces below. One would fly a meter or two, alighting on a beam near the outer wall of the house. If the weather toward noon was distinctly warmer, mosquitoes were seen to fly from beneath the dwelling into the open and in the direction apparently of the nearest trees.

On April 11 there was noted for the first time a perceptible disappearance of *Anopheles* from the woods, and coincidentally the resumption of normal parasitism, biting in the evening rather than in daylight. This was ascertained by a trip on horseback covering 14 miles through the woods and swamps. The horses were rested at frequent intervals, especially in regions where the greatest number of mosquitoes were collected previously. Only a few specimens of *Culex* and *Simulium* were captured.

The normal nocturnal biting habit was brought to the attention of the writer by the manager of Myers plantation along Bolivar Lake, a few miles north of Scott. Complaints of biting at night, and the presence of numerous anophelines in the corner of the screened house gallery, were definite proofs. This occurred during the last week of April and on May 2. It was assumed by the manager that the stiff breezes of recent occurrence drove mosquitoes which emerged from the waters of Kentucky Shoot, on the opposite side of Lake Bolivar, to the plantation manager's house, a distance of 400 meters.

A survey was therefore instituted to ascertain, if possible, the source of the *Anopheles* infestation on Myers plantation. A day was occupied in a small skiff, inspecting Lake Bolivar in the region of Kentucky Shoot. It was found that the latter was a shallow bayou 10 meters in width at its maximum, extending 500 meters through Isole plantation. Dense cypress extended on both sides of the stream, the head of which formed a stagnant swamp draining a ditch from an adjoining cotton field. The open woods along the banks of the shoot formed a pasturage for animals, seen grazing at the time of our survey. Near the mouth of the shoot, in the matted algæ and débris, a few *Aedes* larvæ were found. This form only was encountered for a distance of 75–100 meters, then larvæ of *Anopheles* predominated for a distance of 60 meters. An average of one specimen of *Anopheles* larva to two dipperfuls of water was collected. During the entire period of the inspection, *Aedes* bit us freely, but not a single instance of *Anopheles* biting was observed along the shoot or in the woods near by. While in the pasture land a few *Anopheles* were caught biting us and a grazing pony.

It was concluded from the two days' survey that some source other than Kentucky shoot was responsible for the *Anopheles* infestation across the lake at Myers plantation.

In the collection of 308 *Anopheles* made at Myers plantation at this time (on or before May 2) only specimens of females were caught, and these, in the majority of instances, showed ovaries distended with eggs. It was concluded, therefore, that the spring brood was not in existence before May 2, and that the mosquitoes encountered were probably, without exception, from the overwintered brood.

It was established beyond a reasonable doubt that the new spring brood was not likely to have received the initial infections of malaria. Certainly the females of the winter brood had greater opportunities to obtain human blood to the extent of at least two weeks antedating the appearance of the spring brood. During May 4–10 a special effort was made to collect specimens of the spring brood attacking persons in houses. Many houses of both whites and negroes were visited during this period and the writer exposed himself in an unscreened plantation house in order to collect specimens at first hand. In all this, while not a specimen of male *Anopheles* was seen, the females dissected were either fecund with developed eggs or supplied with masses of fat cells, indicative of matured mosquitoes.

In this search it was particularly noted that the mosquitoes prevalent observed their natural habits of biting and in the usual house infestation. In one morning's collecting 60 specimens of *Anopheles quadrimaculatus* were taken from a negro cabin located on the edge of a swampy woods. The residents, nearly all of whom had been previously infected with malaria, complained that the mosquitoes were so bad at nights as to interfere with sleep and that it was found necessary to resort to smudging. In the kitchen of this dwelling the smoke was very dense; here no mosquitoes were found.

As in previous collecting, no male *Anopheles* were observed, and many of the females were gravid and laid fertile eggs when kept in containers a few days previous to their dissection in the laboratory.

In one negro cabin typical epidemiological factors were presented. The house, of two living rooms, was occupied by 12 persons, 1 at least had crescents in her blood and at least 5 of the remainder harbored asexual parasites. The house was 300 meters distant from the neighbor's on the edge of a clearing in the woods, which in winter is ordinarily very swampy. The nearest trees were 25 meters away. The cabin and adjoining fowl roost yielded 145 specimens of *A. quadrimaculatus*. More than 100 were collected in a single room; 36 of them from behind one of the beds in which a child was then sleeping. A ladder was used to obtain the mosquitoes from the walls and ceiling. The walls were constructed of rough pine boarding and the ceiling of close-fitting finished lumber. No whitewash, as it is commonly seen, was used in this room. The mosquitoes were, for the most part, resting on objects of furniture, particularly upon the three bedsteads in the corners. A black umbrella alongside the bed yielded 3 mosquitoes, the headboard of a bed yielded 7, a spider web near the ceiling yielded 6, and the fireplace within the chimney yielded 12 mosquitoes. Many of these mosquitoes were seen upon the ceiling after being disturbed below. Several specimens were taken from the bed net which covered the sleeping child. The fowl roost yielded 35, and 9 were taken from beneath the cabin. The dis-

tribution of the 145 mosquitoes was as follows: 35 in the chicken house, 9 under the cabin, 101 within the cabin.

In order definitely to establish the fact that hibernation of *Anopheles* exists in this region certain conditions must be present. These would include the absence of propagation during the cold period; certainly no emergences should exist, or, obviously, the criterion for the overwintering of infections will be upset. The presence of eggs and young larvæ will somewhat complicate the findings unless it can be proved that these forms are lying dormant during the entire winter; otherwise certain calculations will be upset by the forthcoming new brood.

The absence of males appears to establish what is probably the most stable criterion of hibernation, or at least one which gives a certain indication that a new brood is not present. It has been observed, upon numerous occasions, and by other workers, that the product of the first emergences are usually males, and that the total number of the two sexes is approximately equal.

All of the evidence that it is possible to offer in this connection favors the assumption that the mosquitoes obtained in the months of February, March, and April are of the fall and winter brood.

In addition to this, a painstaking and persistent search was conducted for the eggs, larvæ, and pupæ of *Anopheles* throughout the watercourses and swamps of the 15 plantations situated in Bolivar and Washington Counties. Not before May 1 were *Anopheles* larvæ taken from the natural habitats, although larvæ were obtained under artificial conditions in the laboratory on April 21. These were produced from a specimen of *Anopheles quadrimaculatus*, caught while biting my arm on April 6 while in the woods. The specimen was captured and fed again April 10. It died April 16 while ovipositing, having laid 10 eggs in a glass dish containing water. The eggs hatched after five days, at an average noon temperature of 23.5°–26° C. This, however, is by no means a true index of what occurs in nature, as it has been possible to remove gravid females from a profound state of hibernation in cold weather and, after a meal of blood, to induce them to lay fertile eggs at room temperature. Certain inferences, however, may be drawn from this phenomenon, namely, that, unless we concede a parthenogenetic relationship, the hibernating females are doubtless fertilized sometime previous to the inactive period; that the males no longer functioning do not hibernate, that the appearance of males in the spring is a certain sign of the propagation of the spring generation.

The initial appearance of the young stages in nature occurred May 2, when larvæ less than twice the length of the egg were collected in several watercourses. Larvæ, in numbers enough to attract attention, did not occur until May 14, when they were found during a

survey of Black Swamp Bayou, on Lake Bolivar plantation, and Gin Bayou, on Nugent plantation. On the former location an ideal habitat was afforded among trees and floatage carelessly thrown into the stream. Many larvæ, one-half to nearly full grown, were collected on this day and only one pupa was seen. On May 15 this pupa emerged in the laboratory as a specimen of a male *A. quadrimaculatus.*

A moderate number of water containers used as traps, distributed throughout several plantations, were utilized in an endeavor to learn the time of initial egg laying and hatching. These were selected, primarily, either for the reason that larvæ had been observed in them in the previous fall and winter or because they were located in advantageous places. The containers were usually stationary vessels, some of which were filled with water, which was allowed to stand undisturbed; in others the water was replenished when necessary. They consisted of wooden water barrels, old boats or canoes serving as water troughs, old wooden drinking troughs full of rain water, iron cisterns, cement water troughs, fire buckets and barrels, and numerous ground cisterns. At least one of these was located on each of the various plantations and inspected regularly at intervals of from three to four days during the months of February, March, and April, when evidences of mosquitoes were absent from natural watercourses.

None of these produced eggs or larvæ until May 25, when, for the first time in this region, two large water barrels were found infested. One barrel contained 30–40 larvæ, 1 to a few days old, and the other harbored older larvæ to the extent of 20–25 specimens. It appears that container infestation generally follows propagation in watercourses. In two instances at least was this observed; one in which an old boat alongside a muddy ditch was not infested until two weeks following the appearance of full grown larvæ in the latter, and another in which wooden barrels kept on a house gallery 25 meters from a flowing stream did not harbor larvæ until 11 days following the infestation of the watercourse.

The finding of *Anopheles* eggs in streams under natural environments is conceded to be a difficult task, even when mosquito propagation is at its maximum, but the difficulties are manifold when attempting to locate these tiny objects during the winter period. The effort met with uniform failure, though, allowing for human limitation, *Anopheles* eggs may have been overlooked in the present studies.

As a partial control to this condition, experiments were conducted in the laboratory, apart from the hibernation investigation, during August 20 to October 15, 1915, to determine at what temperature *Anopheles* lay eggs and the nature of temperature requirements for their hatching.

The following table summarizes the results of these tests. The mosquitoes used were *Anopheles quadrimaculatus* placed in various compartments of two refrigerators, the temperature being carefully registered three times a day. The mosquitoes were captured specimens kept in lantern chimneys, the upper ends of which were closed with coarse bobinet and the lower ends immersed in water contained in flat dishes. The higher temperatures were secured from an electrically controlled, low-temperature incubator set at 19–21° C. and from living room and outdoor exposures at temperatures of 16–35° C.

TABLE NO. I.—*Summarizing the results of egg production and hatching at various temperatures.*

Temperature C.	Number of mosquitoes used.	Results.	Duration of experiment.
4.5– 5.5	15	Negative	Sept.3–Oct. 15.
4.5– 6.5	62	Negative	Aug. 20–Sept. 6.
7.7–11.5	12	Negative	Aug. 20–Sept. 1.
9.5–12.5	12	Negative	Aug. 20–Sept. 6.
13.5–16.7	12	310 eggs. No larvæ	Aug. 20–Sept. 1.
19.0–21.0	12	425 eggs laid in 7 days. Fertile	Aug. 20–Aug. 27.
22.5–32.0	12	280 eggs laid in 4 days. Fertile	Aug. 20–Aug. 24.
21.0–33.5	12	700 eggs laid in 4 days. Hatching begun within 30 hours.	Sept. 3–Sept. 8.
16.0–35.0	14	800 eggs laid in 2 days. Hatching begun in 24 hours.	Sept. 3–Sept. 7.

The temperature tests were conducted during the period from August 20 to October 15, 1915. No cognizance is taken of the fate of the mosquitoes after egg deposition was completed. Interpretation of results in some instances must allow for the unpreparedness of females to lay eggs, although they were kept a reasonable length of time to encourage egg development. Therefore no significance is placed on the percentage of eggs laid at the different temperatures. As a check to the negative results obtained at temperatures included between 5.5°–12.5° C., the mosquitoes surviving at the termination of the tests were subjected to temperatures at which successful egg laying had been previously observed. These favorable temperatures were obtained in the room or outdoors varying from 16° to 35° C. Although eggs were laid freely their germinating powers were markedly enfeebled, since only 35 per cent to 75 per cent of the various lots produced larvæ.

It will be noticed that the temperatures 13.5°–16.7° C. produced 310 eggs, but no larvæ, at the end of 12 days. The fertility of these eggs was tested in the incubator at a temperature of 19°–21° C., when 100 per cent of them hatched within 48 hours.

It must be borne in mind that the conditions of these tests are strictly artificial, especially in subjecting mosquitoes to ice-cooled air when directly removed from much higher outdoor temperature. Probably a fairer test, simulating natural conditions, would obtain in a gradual fall or rise in temperature. This was indicated in one

experiment where 3 mosquitoes, which had not laid eggs at a temperature of 3°–6.5° C. for one week, were transferred accidentally to another compartment of the refrigerator where the temperature registered 9°–12° C. Six hours elapsed before the misplaced cage was discovered, when it was noticed that about 70 eggs had been deposited. No more eggs were laid when the mosquitoes were returned to the low temperature compartment and the eggs subjected to room temperature did not hatch. This phenomenon might be applied to natural conditions of hibernation in which, during the normal low temperature of winter, a rise of 2.5°–5.5° C. would afford an opportunity for *Anopheles* to oviposit.

The temperatures recorded during the hibernation studies are tabulated as follows:

TABLE No. II.—*Temperatures and rainfall during January–May, 1915.*

(Recorded at office of Mississippi Delta Planting Co.)

Week.	January.			February.			March.		
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.
First	−2.5	17.0	6.5	−1.5	15.0	7.0	0.5	17.5	7.0
Second	−2.0	14.0	5.5	0.0	21.0	10.5	2.0	14.0	6.5
Third	−1.5	19.0	6.5	1.5	16.0	10.5	−0.5	18.5	8.5
Fourth	−5.5	17.0	1.5	3.0	20.0	7.0	−3.0	19.5	8.5
Fifth	−1.5	18.0	4.0	.....	.....	.....	1.0	20.5	10.5
Monthly rainfall	3.64			5.56			1.83		
Snow	0.67			.....			.....		

Week.	April.			May.		
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.
First	2.0	25.5	12.0	15.5	32.0	23.5
Second	10.0	28.0	20.0	12.0	31.0	19.5
Third	12.0	31.0	20.5	15.5	34.0	25.0
Fourth	15.0	32.0	23.5	18.5	33.5	26.0
Fifth	19.5	34.0	26.0	12.5	29.0	21.0
Monthly rainfall	0.89			5.57		
Snow	.....			.....		

Collateral studies conducted January 3–9, 1916, at Talladega Springs, Ala., a fairly well isolated country town, furnished us with the following information. At this place the investigation was not made primarily for the study of malaria hibernation, but incidental to securing specimens of anophelines for biting experiments. One week was spent at this place, the nature of which differs in one important particular from that of the locality investigated in Mississippi, the presence of commodious, substantially built animal sheds. These places were found to harbor more than 50 per cent of the total number of *Anopheles* collected. This condition has also been observed in other localities in the South by service officers making malaria surveys during the winter months. Possibly the predilection of anophelines for the blood of cattle and horses may exert an influence on the loss of malarial infectivity of these insects

during the overwintering period. A mosquito which may enter upon the hibernating stage in an infective state and which confines its biting to animals housed for the winter may clear its salivary glands of sporozoites before it again bites a human being.

A few notes concerning conditions of hibernation at Talladega Springs were made in the course of collecting specimens during January 3–9, 1916. An examination was made of five streams and one cement reservoir from which numerous anopheline larvæ had been taken in the course of a mosquito survey in September and October, 1915, by Epidemiologist Griffitts of the service. Several *Culex* egg boats and cast puparia were collected, but neither eggs nor larvæ of *Anopheles* were seen. Two trained observers from this locality reported that developed larvæ and pupæ of *Anopheles* were seen in protected streams in November, and as late as the last week of December, 1915.

Specimens of *Anopheles punctipennis* and *quadrimaculatus* were caught, on the first evening of the investigation (Jan. 3) while biting cattle. The temperature at this time was 21° C. General infestation at this place had been seen a few days previously when an unusual rise in temperature had been recorded.

Some idea of at least the maximum temperature during the survey at this place can be gained from the following table:

Table No. III.

Date.	Temperature.	Time of day recorded.	Date.	Temperature.	Time of day recorded.
	° C.			° C.	
Jan. 3, 1916	15.0	5.30 p. m.	Jan. 7, 1916	20.0	7 a. m.
	12.0	8 p. m.		20.0	12 m.
Jan. 4, 1916	8.0	7 a. m.		10.0	8.30 p. m.
	15.0	12 a. m.	Jan. 8, 1916	8.0	7 a. m.
	14.5	8 p. m.		14.0	12 m.
Jan. 5, 1916	13.5	7 a. m.		9.5	6 p. m.
	21.0	7 p. m.	Jan. 9, 1916	7.5	7 a. m.
Jan. 6, 1916	20.5	7 a. m.		13.5	12 m.
	21.0	6 p. m.			

The following table enumerates the distribution of the 392 anophelines collected in this locality, January 3 to 9, 1916:

TABLE No. IV.—*Giving the distribution of Anopheles found in Talladega Springs, Ala.*

Location.	Number of mosquitoes.	
	A. punctipennis.	*A. quadrimaculatus.*
Within dwellings	7	1
Under buildings	27	.....
Mule and horse stables	81	2
Cattle stables	159	.....
Biting cattle in open	6	1
Harness room	4	.....
Feed house	78	.....
Privies	26	.....
Total (392)	388	4

Dissections were made of 371 specimens collected. No organisms resembling *Plasmodium* were found. It is interesting to note in this connection that mosquitoes which have been interrupted in their hiber-

nation can be induced to bite malarial patients and prove efficient hosts for the infective sporozoites. This was indicated in a series of experiments made with some of the specimens collected at Talladega Springs. This occurred six weeks after they were subjected to the artificial conditions of the New Orleans laboratory.

The results of dissecting 2,122 specimens of *Anopheles* in the Mississippi series have been reported in a previous paper. (Mitzmain, 1915.)

A total of 1,211 specimens was dissected previous to May 15, after which time infected mosquitoes in nature were found. It is of course realized that this lot may possibly include individuals of the spring brood, but unless infections are involved it is found convenient to include them. In this connection it is pointed out that the opportunity for receiving the initial infection favors the rejuvenated winter forms, which are the first to secure blood previous to egg laying and the death of the brood.

The 1,211 specimens were distributed as to species as follows:

A. quadrimaculatus, 1,084 specimens.

A. punctipennis, 97 specimens.

A. crucians, 30 specimens.

The remaining mosquitoes dissected during the month of May were used as indicators of the first appearance of the sporogonic cycle of the malaria parasite for this district. These included 902 specimens of *A. quadrimaculatus* and 9 specimens of *A. punctipennis*. None of the latter became infected, but 3 specimens of *A. quadrimaculatus* showed malaria organisms between May 15 and May 26.

It has been previously stated that the occasional sporadic flight and consequent activity of *Anopheles* mosquitoes were witnessed early in the investigation during February 11–14. Upon the first day of the mosquito attacks the maximum temperature had risen 6.5° C.—from 12.5° C. of the previous day to 19° C.—which rise continued for the three following days to a maximum of 21° C.

When men and horses were exposed in the woods the biting appeared general without apparent host preference. House infestation was reported to be unusually severe, although complaints by the plantation negroes were not generally credited. Besides dissecting as many captured specimens as possible, during the intervals of collecting an effort was made to ascertain the pathogenic effect, if any, of the biting of the infesting *Anopheles*. Fifteen persons besides myself complained of the biting of mosquitoes upon this occasion, and the subsequent medical histories of these individuals were accurately followed for a period of four–five weeks. No case of clinical malaria developed in any of these persons; none of them was using quinine in any form. From this time, extending through March and April, four reliable observers, technically trained or col-

lege-bred men, reported occasional attacks of *Anopheles* mosquitoes. They remained clinically and microscopically negative for malaria.

During the four months of the investigation a total of 49 cases of clinical malaria came under personal observation. The blood from 35 of these cases was examined microscopically and definitely determined as to type. Not a single instance of new infection was established, all of the persons affected having been ill during December, 1914–January, 1915, and proved to have relapsed. In several, with severe paroxysms, plasmodial gametocytes were found.

Since it seems fair to assume that hibernating *Anopheles* in this region can be excluded as winter carriers of malaria, we may turn to the consideration of the rôle assumed by man in perpetuating this disease.

It seemed desirable, in making a parallel study of this nature, to include as many human beings as the number of mosquitoes dissected. This I have succeeded in doing by a collection of blood specimens made from persons most likely to have been exposed to the bites of the mosquitoes examined. This index, to be of practical value, had to be completed while mosquitoes were still hibernating and previous to the general flight.

This was done during the months of February and March, 1915. It was aimed to obtain as many blood specimens as practicable from the persons living on plantations and clearings, where the bulk of mosquitoes had also been collected. The majority of the blood specimens were made from colored and white persons while at work clearing timber, burning trees, making ditches, and tilling preparatory to planting the cotton crop. Likewise homes, stores, and offices were visited, in addition to the facilities offered by the company's physicians in obtaining blood smears from patients and visitors.

A total of 1,184 blood specimens was collected from these sources and the character of the persons examined as well as the results are tabulated below:

TABLE No. V.—*Showing persons examined in February–March, 1915.*

Age (years).	Number examined.					Number infected.				
	White.		Colored.		Total.	White.		Colored.		Total.
	M.	F.	M.	F.		M.	F.	M.	F.	
1 to 3	7	6	12	13	38	8	1	.....	7	16
4 to 5	7	3	15	9	34	2	1	4	3	10
6 to 9	9	7	27	31	74	2	1	21	9	33
10 to 14	8	4	75	60	147	5	.....	41	23	69
15 to 19	6	2	86	46	140	1	1	43	22	67
20 to 29	18	14	135	107	274	9	4	74	43	130
30 to 39	27	19	114	45	205	8	6	42	16	72
40 and over	13	5	170	84	272	7	2	72	14	95
Total	95	60	634	395	1,184	42	16	297	137	492

TABLE No. VI.—*Summary of results of blood examinations, February-March, 1915.*

Total persons examined		1,184
Positive for malaria		492
Malaria index	per cent	41.55
Omitting mixed cases and one quartan:		
Subtertian (317 cases)	do	64.4
Tertian (166 cases)	do	35.6
Number of gametocyte carriers		122
Subtertian cases with gametocytes		104
Tertian cases with gametocytes		18
Percentage of malarial cases with gametocytes	per cent	24.8
Cases of quartan		1
Cases of mixed infections (excluded in the tertian and subtertian totals)		8

Classification of microscopical findings.

Scanty +, 1 organism per 40 fields and over	258
Few ++, 1 organism per 25 fields	198
Moderate +++, 3–5 organisms per field	34
Numerous ++++, 6–10 organisms per field	1

It will be seen from the summary of results of blood examinations that a sufficient number, nearly one-fourth, of the persons found infected harbored the sexual parasites. Material was thus provided for mosquitoes to carry on the spring cycle of new infections. This state of affairs was no doubt continued uninterruptedly, as it was observed that relatively few of the human carriers were aware of, or were concerned about, their infections.

An insidious condition favoring mosquito transmission thus existed here, as little or no efficient protection against mosquito transmission was provided. Of the total number of infections, namely, 492 persons, only 35 persons were known to develop active symptoms subsequent to taking this index. In addition to these, 14 cases of clinical malaria were reported, but not included in the total infected, as they were not examined by the writer.

The latent character of the infection may be appreciated in the prolonged search for the parasites in many of the blood smears examined. In 456 thick-blood films organisms were scanty or few, and in 258 thick films they were exceedingly scanty, and if corresponding thin films had been examined would doubtless have been found negative.

The parasitological conditions present shortly preceding the time when the mosquitoes sought places for hibernation can best be shown in a malaria index of the persons living in this region during the fall of 1914. The table following shows the results of examinations of 1,666 persons residing in the various plantations in which hibernation studies were conducted. The malaria survey which it rep-

resents was conducted in September, 1914, under the direction of Surg. R. H. von Ezdorf, in charge of malaria investigations of the Public Health Service until his death in September, 1916, and he also personally supervised the microscopical examinations tabulated.

TABLE No. VII.—*Showing persons examined in September, 1914.*

Age.	Number examined.					Number infected.				
	White.		Colored.		Total.	White.		Colored.		Total.
	M.	F.	M.	F.		M.	F.	M.	F.	
Under 1 year			1	2	3			1		1
1 to 3			26	22	48			17	8	25
4 to 5	1		42	37	80	1		18	13	32
6 to 9		1	73	66	140			30	34	64
10 to 14	1	1	119	94	215	1	1	42	30	74
15 to 19			92	86	178			42	35	77
20 to 29	3	1	200	196	400	2		73	85	160
30 to 39	1	1	112	86	200	1		44	44	89
40 and over	1		242	151	394			94	62	156
Not stated		4		3	8			2	2	4
Total	7	8	907	743	1,666	5	1	363	313	682

Summary of results of blood examinations—September, 1914.

Total number of persons examined		1,666
Positive for malaria		682
Malaria index	per cent	40.9
Types:		
Tertian (357 cases)	do	52.3
Subtertian (319 cases)	do	47.7
Mixed cases (6) not considered in the percentage above.		
Number of subtertian gametocyte carriers		86
Percentage of subtertian gametocyte carriers	per cent	26.4

In comparing the data obtained in September, 1914, with those obtained in February and March, 1915, it is evident that the malaria index existing during the winter months remains little altered. It is patent, at least, that recoveries following treatment do not favorably influence the important bearing of the gametocyte carrier. It will be observed that not only is there a relative increase in the number of subtertian gametocyte carriers, but an actual increase, the percentage being raised during latency from 26.4 per cent to 32.8 per cent, and the total number is increased from 86 to 122. It must be observed, however, in this connection, that probably a smaller percentage of the winter carriers harbored suitable numbers of gametocytes to be capable of infecting *Anopheles* mosquitoes.

Of the total number of 1,184 persons examined in February and March, 1915, it is possible to draw certain comparative deductions from a representative group of 103 carriers of all ages distributed among 11 plantations. The persons in this group were selected be-

cause they had been examined previously in September, 1914, and, with few exceptions, had not changed their place of residence. It was found that none of the 103 persons had received specific treatment, so that the recoveries (so far as the microscopical findings can demonstrate) were spontaneous, and the continued presence of parasites could be ascribed either to relapses or to latent infections. In this group 48 cases were found still to harbor the malaria organisms, while the remaining 55 were negative at the time of the reexamination. The positive cases were distributed as follows:

Thirty-three (68.7 per cent) subtertian, of which 14 harbored gametocytes.
Fifteen (31.3 per cent) simple tertian, of which one harbored gametocytes.

It is of interest to note that 8 of the 15 gametocyte carriers were also crescent carriers in September, 1914.

These 15 infected persons, according to the medical records of the plantation health officer, showed no clinical symptoms of the disease during the winter period.

The importance of the public health relation of gametocyte carriers was brought vividly to the attention of the investigator in the discovery of three infected *Anopheles quadrimaculatus* in dwellings which were definitely proved to contain individuals harboring gametocytes. These persons are included amongst the eight infected with gametocytes in September, 1914, and again in March, 1915.

The finding of these infected mosquitoes and the demonstration of the probable human sources of the infection serves to show for this region the intimate relations existing in the perpetuation of the disease through the winter and in linking together the two malarial seasons—autumn and spring.

SUMMARY AND CONCLUSIONS.

The review of the literature on the overwintering of malaria organisms in man and mosquito and on the habits of anophelines during hibernation leads to the impression that the conditions found elsewhere are essentially reproduced in the region investigated in the southern part of the United States.

Hibernation studies during Febuary–June, 1915, were made in territory comprising 15 plantations in Bolivar and Washington Counties, Miss., having a malaria index of over 40 per cent.

Search for hibernating anophelines was conducted in places commonly known or likely to harbor them. The places inspected included residences, outbuildings, animal sheds, cotton houses, swampy and dry woods. Mosquitoes were found to be generally absent from all places except under houses and in the depth of woods. Interiors of dry hollow trees and those with roots in standing water were devoid of resting anophelines. This was ascertained by the aid of electric torches and by sulphur fumigation.

Persistent search for anopheline eggs, larvæ, and pupæ which might have hibernated proved fruitless.

The conclusion is drawn that, in this region in northwestern Mississippi, only the adult female mosquito of *Anopheles* hibernated. Collateral studies made in Alabama gave similar results.

Hibernation data to be of intrinsic value must insure absence of fresh emergences and consider only the presence of the brood known to have emerged prior to the onset of the cold weather. The characteristics of the hibernating mosquito are indicated by the presence of eggs and abundant stored fat cells in the body of the old female, and by the entire absence of male anophelines. It is concluded that the appearance of male anophelines indicates recent emergences, and is interpreted to indicate the arrival of the spring brood.

A control of field observations concerning laying of eggs during winter was provided by laboratory experiments with *Anopheles quadrimaculatus*. These laboratory tests gave the information that, with more than 100 apparently gravid females, egg deposition did not take place at temperatures between 4.5° C. and 12.5° C.

In another laboratory experiment, eggs were laid at temperatures ranging between 13.5° C. and 16.7° C., but these did not hatch except at temperatures above 16° C.; the optimum established being at temperatures between 19° C. and 21° C. These experimental data, applied to conditions found to exist in the region studied, would provide for egg deposition and hatching beginning April 21, when a mean temperature of over 16° C. was sustained. This fits in perfectly with an experimental case in which a hibernating female *Anopheles*, caught April 10, 1915, was induced to bite and laid eggs April 16, which hatched April 21.

Hibernation conditions were observed in January, 1916, in the State of Alabama at a point having the same latitude as Bolivar County, Miss. Probably the conditions found here are more representative for the southern United States. Stables in which cattle and horses were housed for the winter yielded more resting anophelines than elsewhere. A total of 371 specimens of *Anopheles* was collected here and, upon dissection, was found negative for malaria parasites.

It was ascertained, during the course of the winter studies in the region investigated, that occasional biting of roused hibernating *Anopheles* did not have any pathogenic significance, and all of the clinical malarial infections occurring in this region during this period were proved to be recurrences of former attacks.

It was concluded that hibernating anophelines, collected in the region investigated, did not harbor parasites of malaria. This was determined after an examination of 2,122 dissected anophelines, of which 1,211 specimens were examined before May 15, 1915. Among

the remaining 911 specimens, serving as a malaria indicator for the spring season, 3 mosquitoes between May 15 and May 26, were definitely shown to contain oocysts, indistinguishable from those seen in mosquitoes experimentally infected with human malaria.

In the investigation of man as the responsible winter carrier, 1,184 persons, residing on the plantations selected, were examined for malaria parasites. Four hundred and ninety-two infections were identified microscopically; 317 cases were of the subtertian type, 8 were mixed infections, and the remainder were of the simple tertian type, with the exception of one quartan case.

In the consideration of these infections an important fact stands out: *nearly one-fourth (24.8 per cent) of the human carriers harbored gametocytes.*

It was proved that from a group of 103 persons, examined in March, 1915, 8 of the 15 gametocyte carriers identified, were similarly infected during the preceding fall.

The incrimination of man as the sole winter carrier is emphasized by the fact that 3 malaria-infected *Anopheles quadrimaculatus* were found in the homes of these gametocyte carriers during May 15 to May 26, previous to which time 1,180 specimens of *Anopheles* from this source were found to be negative.

ACKNOWLEDGMENT.

The writer wishes to acknowledge his appreciation to the various officials of the Mississippi Delta Planting Co. for the material assistance rendered in the collection of data for this study. Through the kindly services of the general manager, Prof. Fox, and his assistant, Mr. Young, the cooperation of the plantation managers was obtained in securing blood specimens. The temperature chart and the sketch map of the plantations were obtained through the assistance of these gentlemen. Acknowledgment is likewise made to Dr. Miller and Dr. Lane, of the medical staff, for their intelligent cooperation at all times. Thanks are due the chief medical officer, Dr. Miller, for providing generous laboratory facilities and offering personal assistance in collecting mosquitoes and in securing blood specimens.

REFERENCES TO THE LITERATURE.

Annett, H. E., and Dutton, J. E. (27 Apr., 1901). A Preliminary Note on the Hibernation of Mosquitoes. Brit. Med. Journ., p. 1013.

Austen, E. E. (Mar., 1901). The Genus Anopheles. The Practitioner, vol. 66, No. 393, p. 343.

Craig, C. F. (1909). The Malarial Fevers. (New York, William Wood & Co.) p. 69.

Deaderick, W. H. (1911). Practical Study of Malaria. (Philadelphia, W. B. Saunders Co.) p. 71.

Giles, G. M. (1902). A Handbook of the Gnats or Mosquitoes, 2d ed. (London, John Bale, Sons & Danielsson, Ltd.) p. 141.

Henson, Graham E. (1913). Malaria. (St. Louis, C. V. Mosby, Comp.) p. 121.

Herms, W. B. (1915). Medical and Veterinary Entomology. (New York, Macmillan Co.), pp. 112, 113.

Howard, L. O., Dyar, H. G., Knab, F. (1912). The Mosquitoes of North and Central America and the West Indies (Washington, D. C., Carnegie Institution), pp. 119, 120.

Manson, Patrick (Mar., 1901). Etiology, Prophylaxis, and Treatment of Malaria. The Practitioner, vol. 66, No. 393, p. 256.

Manson, Patrick (1914). Tropical Diseases, 5th ed. (London, Cassell & Co.) p. 102.

Mitchell, E. G. (1907). Mosquito Life. (New York, G. P. Putnam Sons.) p. 94.

Mitzmain, M. Bruin (16 July, 1915). Anopheles as a Winter Carrier of Plasmodium. (Reprint No. 290, from the Public Health Reports.)

Nuttall, G. H. F., and Shipley, A. E. (1901). Studies in Relation to Malaria. Journal of Hygiene, Vol. I, No. 3, p. 451.

Patton, W. S., and Cragg, F. W. (1913). A Textbook of Medical Entomology. (London, Christian Literature Society for India.) p. 259.

Rosenau, M. J. (1913). Preventive Medicine and Hygiene. (New York and London, D. Appleton & Co.) p. 202.

Scheube, B. (1902). The Diseases of Warm Countries. A Handbook for Medical Men, 2d ed. (Philadelphia, P. Blackiston's Son & Co.), pp. 115, 116.

Smith, J. B. (Feb., 1904). The Common Mosquitoes of New Jersey. New Jersey Agricultural Experiment Station Bulletin 171, p. 32.

Stephens, J. W. W. (1908). Malaria in its Relation to the Mosquito. Nothnagel's Encyclopedia of Practical Medicine, American Edition, pp. 204, 205.

Von Ezdorf, R. H. (1915). Malaria. Reference Handbook of the Medical Sciences. (New York, Wm. Wood Co.) Vol. VI, p. 211.

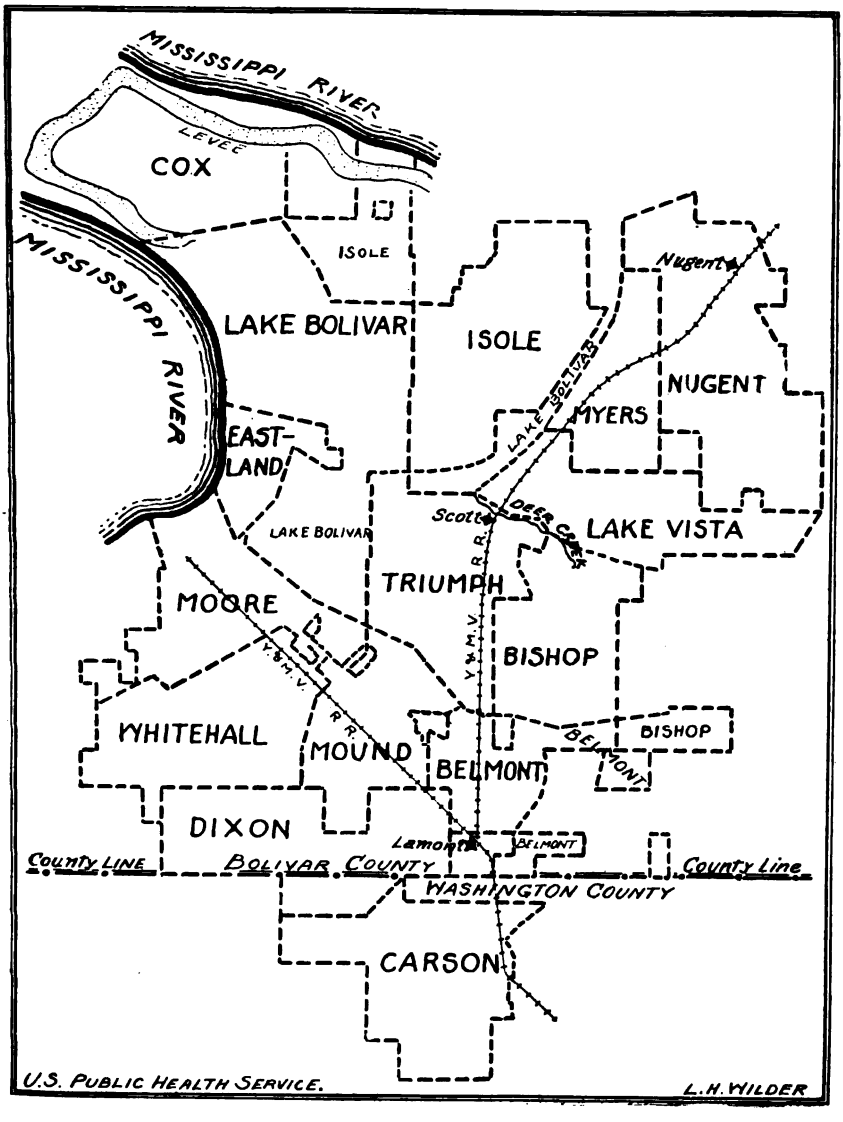


Fig. 1.—Map showing individual plantations of Mississippi Delta Planting Co.

Fig. 2.—Upturned root mass of fallen tree where a few specimens of *A. quadrimaculatus* were found among the exposed root fibers on March 28.

Fig. 3.—Excavation made by falling tree, exposing roots, pool of water beneath. Here in February and March culicines were found in larval and pupal stages and emergences observed. *Anopheles* absent.

Figs. 4 and 5.—Showing method of searching hollows, in standing and fallen timber, for hibernation forms. The tree shown in figure 5 was seen to harbor many *Anopheles* in September, 1914.

Fig. 6.—A hole in a hollow tree receiving sulphur dioxide fumigation.

Fig. 7.—Showing understructure of plantation houses, which were found to be fruitful sources of hibernating *Anopheles*.

Fig. 8.—Showing understructure of plantation houses, which were found to be fruitful sources of hibernating *Anopheles*.

Fig. 9.—Mr. M.'s house, showing means of access by mosquitoes through lattice work and holes in brick understructure. Under this house the first hibernating *Anopheles* were collected during the first week of February.

Fig. 10.—Typical cypress trunk with fissured structure in which leaves found lodgment to serve as possible hiding places for resting anophelines. Such places were not found to shelter mosquitoes.

Fig. 11.—Canvas covered canoe, which remained undisturbed during fall and winter. Shows the ripped canvas in the end of the canoe where several inches of water remained. No mosquitoes of any stage were seen.

Fig. 12.—Showing the method adopted by use of horses as bait to attract anophelines in the woods.

Fig. 13.—An inundated "borrow pit" on Whitehall plantation. *Anopheles* larvae were not found here during February.

Fig. 14.—Junction of Deer Creek and Lake Bolivar where in late fall larvae and pupae of *A. quadrimaculatus* were found. Seven persons among the fishing women on the bridge proved to be winter carriers of *Plasmodium*.

Fig. 15.—Group of negro tenants on Lake Vista plantation. No case of sickness reported here, yet 43 per cent were carriers of malaria during February and March.

Fig. 16.—Group of tenants on Myers plantation. Fifty per cent were infected with malaria during February and March. No clinical case observed. The head of the family proved to be a gamete carrier.

Fig. 17.—Showing apparently healthy negro tenants of Mound plantation engaged in clearing operations. Five of the eight men in this picture were winter carriers of malaria; two of these harbored gametocytes.

Fig. 18.—Photomicrograph of a stained preparation showing young oocysts on the stomach of an *A. quadrimaculatus* dissected May 15, 1915. This represents the initial infection of the spring season.

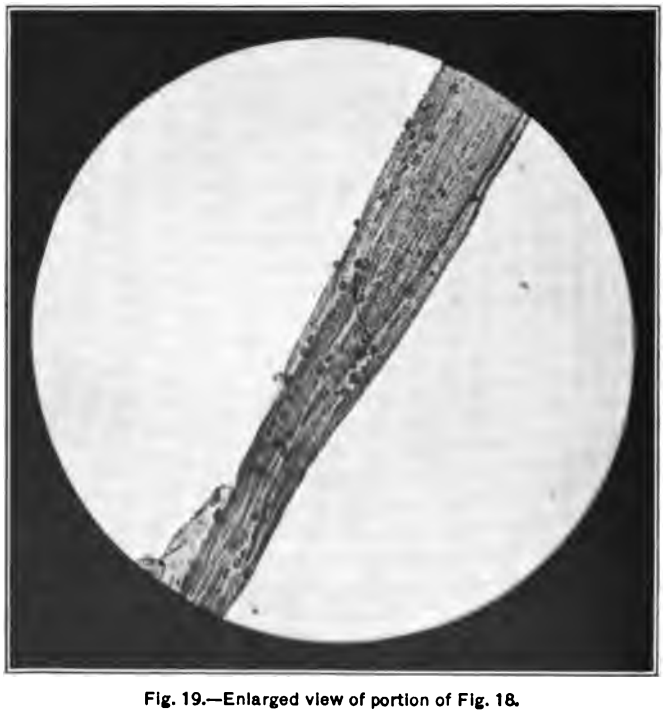


Fig. 19.—Enlarged view of portion of Fig. 18.

RELATED PUBLICATIONS.

AVAILABLE REPRINTS OR BULLETINS ON MALARIA ISSUED BY THE PUBLIC HEALTH SERVICE, FROM WHICH COPIES MAY BE OBTAINED WITHOUT COST.

PUBLIC HEALTH BULLETIN.

79. Impounded Water. Surveys in Alabama and South Carolina during 1915 to determine its effect on prevalence of malaria. By H. R. Carter, J. A. A. Le Prince, and T. H. D. Griffitts. 1916.
84. Is Mosquito or Man the Winter Carrier of Malaria Organisms? By M. Bruin Mitzmain. December, 1916.

REPRINTS FROM THE PUBLIC HEALTH REPORTS.

28. Prevention and Destruction of Mosquitoes. By Joseph Goldberger. July 17, 1908.
105. Antimalarial Measures for Farmhouses and Plantations. By H. R. Carter. December 6, 1912.
108. Malarial Fevers—Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. December 27, 1912.
156. Malaria in North Carolina. By H. R. Carter. December 19, 1913.
159. Malarial Index Work. Methods used in Obtaining Blood, making Blood Smears and Staining. By R. H. von Ezdorf. December 26, 1913.
160. Malarial Fevers. Prevalence and Geographic Distribution in Arkansas. By R. H. von Ezdorf. January 2, 1914.
170. Prevention of Malaria. Suggestions on How to Screen the Home to Keep out Effectively the Mosquitoes Which Spread the Disease. By R. H. von Ezdorf. February 27, 1914.
172. Malarial Fevers. Prevalence and Geographic Distribution in South Carolina, Georgia, and Florida. By R. H. von Ezdorf. March 13, 1914.
175. Quinine Prophylaxis for Malaria. By H. R. Carter. March 27, 1914.
180. Malarial Fevers in the United States. By R. H. von Ezdorf. April 10, 1914.
186. Malarial Fevers. Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. May 1, 1914.
193. Malarial Fever. Prevalence and Geographic Distribution in Mississippi, 1913. By R. H. von Ezdorf. May 22, 1914.
217. Mosquitoes and Malaria. Report on a Short Trip in Eastern North Carolina. By Ch. Wardell Stiles. September 4, 1914.
244. Impounded Water. Some General Considerations on its Effect on the Prevalence of Malaria. By H. R. Carter. December 25, 1914.
248. Impounded Waters. Their Effect on the Prevalence of Malaria—Survey at Blewetts Falls. By H. R. Carter. January 1, 1915.
257. Impounded Waters. A Study of Such Waters on the Coosa River in Shelby, Chilton, Talladega, and Coosa Counties, Ala., to Determine the Extent to which They Affect the Production of Anophelines, and of the Particular Conditions which Increase or Decrease their Propagation. By J. A. A. Le Prince. February 12, 1915.

258. Malaria Control. Drainage as an Antimalarial Measure. By J. A. A. Le Prince. February 19, 1915.
260. Control of Malaria. Oiling as an Antimosquito Measure. By J. A. A. Le Prince. February 26, 1915.
272. Anopheline Surveys. Methods of Conduct and Relation to Antimalarial Work. By R. H. von Ezdorf. April 30, 1915.
277. Malaria in the United States. Its Prevalence and Geographic Distribution. By R. H. von Ezdorf. May 28, 1915.
290. Anopheles as a Winter Carrier of Plasmodium. The Mosquito as a Prophylactic Indicator. By M. Bruin Mitzmain. July 16, 1915.
324. Anopheles Punctipennis Say. Its Relation to the Transmission of Malaria. Report of Experimental Data relative to Subtertian Malarial Fever. By M. Bruin Mitzmain. February 11, 1916.
337. Tertian Malarial Fever-Transmission Experiments with Anopheles Punctipennis. By M. Bruin Mitzmain. May 12, 9116.
359. Anopheles Infectivity Experiments. An attempt to Determine the number of persons one Mosquito can Infect with Malaria. By M. Bruin Mitzmain. September 1, 1916.

SUPPLEMENTS TO THE PUBLIC HEALTH REPORTS.

11. What the Farmer Can Do to Prevent Malaria. By R. H. von Ezdorf. February 13, 1914.
18. Malaria—Lessons on its Cause and Prevention. (For use in Schools.) By R. H. Carter. July 17, 1914.

○

85

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

LIBRARY OF
S. H. OSBORN M. D.

PUBLIC HEALTH BULLETIN No. 85
JANUARY, 1917

JUN 2 3 Hccd

MINERS' CONSUMPTION

LIBRARY OF
S. H. OSBORN M. D.

A STUDY OF 433 CASES OF THE DISEASE AMONG ZINC MINERS IN SOUTHWESTERN MISSOURI

By A. J. LANZA
Passed Assistant Surgeon, United States Public Health Service

NOV 7 - 1937

WITH A CHAPTER ON ROENTGEN RAY FINDINGS IN MINERS' CONSUMPTION

By Dr. SAMUEL B. CHILDS

PREPARED BY DIRECTION OF THE SURGEON GENERAL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
10 CENTS PER COPY

CONTENTS.

	Page.
Miners' consumption: A study of 433 cases of the disease among zinc miners in southwestern Missouri. By A. J. Lanza	5
Introduction	5
History of disease	6
Working conditions	7
Nature and clinical description of miners' consumption	8
Classification of cases. Relationship of miners' consumption to tuberculosis	12
Tabulation of results of physical examinations	14
First stage	14
Second stage	18
Third stage	21
Summary of tables	25
Analysis of facts bearing on deaths	26
Relation of miners' consumption to living conditions and to tuberculous infection	28
Conclusions	30
Roentgen-ray findings in miners' consumption based upon a study of 150 cases. By Samuel B. Childs	31
Introduction	31
First stage	32
Second stage	33
Third stage	33
Appendix: Cases typical of the various groups in miners' consumption	35

MINERS' CONSUMPTION.

A STUDY OF 433 CASES OF THE DISEASE AMONG ZINC MINERS IN SOUTHWESTERN MISSOURI.

By A. J. LANZA, Passed Assistant Surgeon, United States Public Health Service.

The following paper is based upon a study of 433 cases of miners' consumption.

That there is an unusual amount of tuberculosis among the sheet-ground miners in southwestern Missouri has been a matter of common knowledge in that part of the country for some years, this condition of affairs being generally ascribed to exposure to the flinty rock dust caused by drilling and other underground operations. The Jasper County Antituberculosis Association was organized, and in 1914 this society, through its secretary, Miss Hackett, petitioned the Surgeon General of the Public Health Service for assistance. As the Public Health Service was cooperating with the United States Bureau of Mines in studies of miners' diseases and mine sanitation, the Joplin district was deemed a favorable field for investigation, and the writer, together with Mr. Higgins, mining engineer of the Bureau of Mines, was sent there to investigate and report on the prevalence, causes, and methods of control of pulmonary disease among the miners. The results of these studies were reported in a bulletin published by the Bureau of Mines.[1] Advantage was taken of this cooperation to carry on a more detailed study of silicosis (miners' consumption), with special reference to physical signs, intercurrent affections, family incidence, and Roentgen-ray findings.

Physical examinations of a large number of miners were deemed necessary. Accordingly it was advertised throughout the district that any bona fide miner would be examined without charge at the office of the Public Health Service in Webb City, Mo. At every opportunity miners were urged to come, whether they felt sick or well, whether or not they had any apprehension as to their physical condition. As a result 720 miners presented themselves and were

[1] Technical Paper 105. Pulmonary Disease Among Miners in the Joplin District, Mo., and its Relation to Rock Dust in the Mines. A preliminary report by A. J. Lanza and Edwin Higgins. 1915.

examined, without any selection and regardless of their symptoms. Naturally, however, most men came because dyspnea or a cough gave them reason to suspect that they had lung trouble.

The writer takes this occasion to express his thanks and sincere appreciation to those who so generously contributed their assistance; particularly to Dr. Childs, of Denver, who contributes the chapter on the Roentgen-ray findings, and who interpreted the series of X-ray plates; to Dr. Dumbauld, of Webb City, Mo., who took the X-ray plates; to Miss Sieber, of Joplin; to Miss Hackett, of Carterville, Mo.; to Dr. Gelien, of Denver; to the Missouri State mine inspectors; and to the physicians and mine operators of Jasper County, Mo.

HISTORY OF DISEASE.

Miners' consumption has been recognized for a number of years as the most important health hazard of the metal mining industry, and as one probably widespread throughout our mining districts, but until this investigation it had never been the subject of State or Federal inquiry in this country. Other countries have devoted considerable attention to this subject, however, and the report of the Miners' Phthisis Committee, Union of South Africa, Cape Town, 1912, states (p. 5): "It has long been known that miners engaged in metalliferous mining in hard rock are prone to suffer to a greater extent than do the general population from chronic lung disease. But it has been especially during the past 15 or 20 years, a period which coincides broadly with the time during which rock drills have come into general and increasing use in mining operations, that this excessive incidence of lung disease has attracted serious attention in the larger mining centers of the British Empire, and has in almost every important mining area been the subject of official investigation."

The first commission to inquire into miners' phthisis was appointed in the Transvaal in 1902. A number of reports of various Government commissions in South Africa have appeared since then. In 1904 the health of Cornish miners was the subject of an official report. In Australia in 1905, 1907, and 1910 there were issued similar reports. To these investigations of miners' diseases in various parts of the British Empire we are indebted for arousing interest and perhaps apprehension as to our own mining health hazards. Miners and mining officials of this country have long been cognizant of the pulmonary disease incident to metal mining in hard rock: "miners' consumption" is the term that has come into general use here as "miners' phthisis" has in South Africa, and the miners themselves have always distinguished this form of consumption from the "old-fashioned" or "catching" kind. The miners have also recognized

the relationship between miners' consumption and rock dust, and while they have many local notions on the subject, in the main their ideas are fairly correct; thus in some of the Rocky Mountain mining camps a particularly dusty type of machine drill is popularly known as the "widow maker."

But while the miner—employer and employee—has appreciated with a fair amount of accuracy the dangers to health to which his occupation exposed him, very little has resulted from that knowledge in the way of prevention. In the Joplin district, it is true, strenuous efforts are being made to overcome rock dust, but these efforts are of comparatively recent origin. However, the miner, naturally accustomed to a life of risk, has not been more backward in improving his working conditions than has the lead worker, the phosphorus worker, or other worker at dangerous or hazardous trades. In all, improvement has been accomplished largely from without, often at the protest, frequently with the resistance of those most concerned. Only, in the case of the metal miner, his health hazards have not received the attention that has been focussed on the others and consequently objectionable conditions have persisted for a longer time.

WORKING CONDITIONS.[1]

The Joplin mines are zinc and lead mines. Certain of them, known as "sheet-ground" mines, consist of large connected chambers or rooms, 150 to 200 feet underground; the zinc ore is found embedded in flint which lies in horizontal layers or sheets; hence the name. Mining operations, drilling, blasting, etc., are therefore done in flint, an exceedingly hard rock with a silica content of over 95 per cent. This flint forms a very fine, hard, sharp, and insoluble dust, which permeates the underground atmosphere to a varying extent and which, naturally, is extremely irritating to the lungs when inhaled, causing the condition known as miners' consumption.

The bulk of the underground workers are composed of machine-drill operators, their helpers, and shovelers who shovel the ore into the containers in which it is hoisted to the surface. In the Joplin mines both classes of miners are about equally exposed to dust, and it was impracticable to differentiate between these types of work in their relation to the incidence of miners' consumption. The shovelers work very hard, more so than the machine men, their work often helping to break down their health. Men who work on the surface may contract miners' consumption. The hoisterman may inhale rock

[1] For a detailed description of working conditions in the mines of the Joplin district, also for methods of securing dust and air samples underground, the reader is referred to Technical Paper 105 and Bulletin No. 132, United States Bureau of Mines, entitled "Pulmonary disease among miners of the Joplin district, Missouri, and its relation to rock dust in the mines," preliminary and final reports.

dust when the ore is dumped after being hoisted out of the mine; in the mills where the ore is crushed, the rock dust may be present in sufficient quantity to imperil the health of the millmen.

There are no other important health hazards in the Joplin mines, the ventilation being usually good and the working temperature favorable, while powder fumes are not usually present in sufficient degree to be a factor in disease production.

NATURE AND CLINICAL DESCRIPTION OF MINERS' CONSUMPTION.

With flint dust as the etiological factor, we have in miners' consumption a pneumonoconiosis, which, being due to silicious dust, is properly termed "a silicosis." While the latter name is correct, the term "miners' consumption" has been so widely accepted in this country that it seems best to retain it, especially as it is in itself descriptive of an occupational disease.

As in other dust diseases, the result of the inhalation of hard rock dust is a fibrosis, with perhaps actual destruction of the alveolar cells by direct action of the dust; a gradual loss of function, evidenced by a continually increasing dyspnea on exertion, is produced by this entirely mechanical condition. As Thompson[1] states:

> The morbid process is a chronic interstitial inflammation of the lungs usually most intense at the apices, but to a considerable extent found elsewhere. The lung is pervaded with minute nodules, so that the freshly cut surface feels rough and grates upon the knife. Within the nodules are permanently imbedded the irritating particles. The bronchial and mediastinal glands are similarly filled with the disseminated particles which have been conveyed to them by the leucocytes.

It is not intended to pursue further the pathology of miners' consumption at this time, but rather to consider the disease in its clinical aspects.

The condition of silicious dust fibrosis, once established, may persist until complete incapacity for work and death from some intercurrent malady occur, or the silicosis may be complicated by a tubercle or pyogenic infection.[2]

As would be expected, the chief symptom of miners' consumption is dyspnea on exertion. The dyspnea comes on gradually, sometimes preceded by a bronchitis, more often not. As the fibrosis advances, the dyspnea increases in severity until it becomes urgent and disabling. It is conspicuous in the clinical picture because it so completely overshadows the other symptoms. The majority of the patients examined in this investigation looked well, even with severe dyspnea, and aside from this complaint many of them felt well.

[1] The Occupational Diseases, W. Gilman Thompson, M. D.

[2] See relationship of miners' consumption to tuberculosis below.

They were mostly big, robust men and, even when suffering from a considerable disability, showed nothing in their appearance to indicate the fact. As their dyspnea increased from year to year, they would notice a falling off in the amount of work they could do; especially was this the case with the shovelers, who, working by the piece, usually kept a record of their work. The dyspnea was evident on exertion only. In early cases it was not so noticeable after the men had gotten "warmed up," and it was not uncommon to have them say that their wind was better underground than on the surface. Throughout the series of cases quoted later there was no evidence that the dyspnea was due to vesicular emphysema or any condition of the lungs other than fibrosis (except complications seen in terminal stages). All cases in which the dyspnea could be attributed, either in whole or in part, to cardiac or other nonpulmonary affections were classed as "doubtful" or "miscellaneous," and are not included in the series "Miners' consumption."

Pain in the chest usually appears early and persists throughout, though often appearing to remit in the terminal stages. At first these pains are apt to be varied in location, now in one part of the chest and now in another. Later on they remain for a considerable time in one place. Their intensity varies, being most often moderately severe and usually unaccompanied by any pleural rub or other physical sign which would define them. In the beginning patients are most apt to complain of pain over the front of the chest, on both sides, especially the upper half. This pain is probably due to the irritation of the finer bronchial passages, as evidenced by the peribronchial thickening seen in the X-ray plates of early cases.

Diminished expansion was complained of by the majority of patients—that is to say, the inability to draw a deep breath was sufficiently marked to be a basis for complaint when their histories were taken, even in the early cases. In those with a well-developed fibrosis the inability to draw a deep breath was striking, all the inspiratory muscles being brought into play in the effort. If we can imagine a man with his chest bound around with transparent adhesive plaster, we can form a mental picture of how useless were the efforts at deep inhalation made by these patients.

Loss of weight was a constant symptom. Like the dyspnea, it came on gradually, but was rarely of any considerable extent until the patient was in a far-advanced condition.

Cough occasionally antedated dyspnea; in some cases there was an initial bronchitis that ushered in the fibrosis, but this was uncommon. Usually cough did not appear until the dyspnea was noticeable, though both symptoms may appear simultaneously. Cough was apt to be severe at night and in the morning. Many patients

complained of vomiting their breakfast; and when this occurred with more or less regularity the miners were accustomed to do without their breakfast, taking their first meal at noon. Apparently, if they did not eat they did not cough, and it is possible that this after-breakfast vomiting may not be due entirely to a cough of pulmonary origin but also to direct irritation of the gastro-intestinal tract by ingested dust. This explanation, while in accord with the experiments of Vilaret, Calmette, and others, is offered here purely as a suggestion. Occasionally patients were seen who had no cough, and cough was also frequently increased in severity at varying periods, due to "colds," bronchitis, and similar disturbances of the respiratory tract to which this class of patients are very subject. Most generally the cough was in proportion to the amount of sputum and, when present to a marked extent, was indicative of infection.

Hemorrhages were rather frequent, becoming more so as the silicosis advanced. Thus, in this series, 3.3 per cent of those in the first stage had hemorrhages; in the second stage, 10.5 per cent; in the third stage, 20.5 per cent of the uncomplicated cases and 30 per cent of those with an added tubercle infection.

Night sweats were uncommon. When present they denoted an infection, either tuberculous or pyogenic; but many cases with such infections had no night sweats, and their value for diagnosis was a positive one only.

The blood-pressure records gave little information. As in other chronic diseases, the downward progress of the patient was accompanied by a gradual fall in the blood pressure; there was no elevation observable in the early cases, and there was a noticeable diminution in cases complicated with an infection as compared with the noninfected ones in the same stage.

The sputum varied in amount from nothing to a large quantity, depending on the presence of tuberculous or pyogenic infection and, to some extent in the early cases, of bronchitis. In the later stages, with breaking down of lung tissue, the sputum was very characteristic, in fact diagnostic, being of a marked slaty blue color and of a very tenacious consistency. This color is due to the presence of flint dust, previously inhaled and embedded in the lung tissues. In doubtful cases the appearance of this sputum is sufficient to determine a diagnosis.

In slide preparations of the sputum, made in the usual manner, the flint dust could be readily seen. A number of these slides were sent to the Pittsburgh laboratory of the Bureau of Mines and examined by Dr. Reinhardt Thiessen, who reported, in part, as follows:

> The sputum preparations were examined by both oil immersion objective with ordinary illumination and the paraboloid or ultra condenser. * * * All the preparations contained a considerable amount of rock-dust particles. * * * The rock dust is of the same nature and appearance as that

gathered on slides by Mr. Higgins in his rock-dust sampling experiments. It is the dust of chert,[1] but what minerals are present it is impossible to say. * * * The sizes of the particles are also approximately the same as those in the proparations of mine-dust samples, but the larger particles are fewer in number. There are comparatively few particles measuring over 10 microns in diameter, but a large number measure between 2 to 5 microns, with rapidly increasing numbers of smaller sizes down to particles of colloidal dimensions. * * * Slide 27 contains the most rock dust.

Attention is particularly called to the statements of the sizes of the rock dust particles. This agrees with the results of investigations as stated by Dr. Moir:[2]

In examining the lungs of victims of miners' phthisis it has been found that the diameter of quartz particles that lodged permanently in or on the tissues averaged less than 3 microns, that very few were above 8 or 10 microns, and none were greater than 12 microns.

All samples of sputum were examined in a uniform manner. The sputum was first digested with a mixture consisting of double strength Labarraque's solution, to which was added 7½ per cent sodium hydrate; one part of this solvent was added to five parts of sputum, and let stand until the sputum was about the consistency of water, a little chloroform and alcohol solution was then added, and the whole centrifuged.[3] All of the resulting sediment from each sample was smeared and examined for tubercle bacilli.

Physical examination was frequently disappointing and generally unsatisfactory in that the physical signs were so inadequate apparently to account for the symptoms. Even in cases with well-marked dyspnea it was not uncommon to find practically nothing on examination. This was true in all but the far-advanced cases.

Percussion was inconclusive in all but advanced cases. Most of the men were very muscular, especially around the shoulders and upper part of the chest.

The most constant sign was weakened breath sounds. Weakened breath sounds were most frequently noticed in the upper half of the chest, and in earlier cases could often be detected behind sooner than in front. As the fibrosis progresses the breath sounds become weaker and weaker, at times being entirely inaudible in parts of the chest. In the far-advanced cases, however, with considerable breaking down of tissue and riddling of the lungs, the breath sounds are harsh and exaggerated; also it was in these cases only that prolongation of expiration was observed. A number of times it was noted that portions of the chest would be entirely free from breath sounds, but that on examination some time later breath sounds would be audible over the same area. This was probably due to a mechanical blocking off of a portion of the lung, which seems likely in view of the

[1] Chert—impure flinty rock, including the jaspers. Dana, Textbook of Mineralogy.
[2] Journal Chemical, Metallurgical and Mining Society of South Africa, August, 1915.
[3] Practical Bacteriology, Stitt.

fact that pulmonary abscesses are fairly frequent in miners' consumption.

Diminished vocal resonance was not infrequently noticed over areas of weakened breath sounds.

Moist râles were almost never present in early cases, and in those more advanced were usually accompanied by a variety of adventitious sounds. Moist râles following cough, and unobscured by other sounds, as commonly heard in ordinary pulmonary tuberculosis, were hardly ever observed in these cases of silicosis. Sibilant râles and a sound suggestive of a friction rub, but distinct from it, were among the adventitious sounds most frequently heard. Moist râles, while usually indicating an infection, had, like night sweats, only a positive value; many cases with a considerable amount of sputum, with and without tubercle bacilli, had no moist râles. In some of the advanced cases the variety and extent of the adventitious sounds just mentioned were truly remarkable.

To summarize, aside from the distinguishing feature of a progressive dyspnea on exertion, there is little of constant value in either symptoms or signs. For diagnosis, the most important symptoms are dyspnea, associated with pain in the chest and diminished expansion; when these are present in a miner with a history of exposure to rock dust, the diagnosis of miners' consumption declares itself, even though the patient may be the picture of robust health. While slaty blue sputum, when present, is diagnostic, yet the physical examination of the patient is, in itself, insufficient without a knowledge and consideration of the occupation.

CLASSIFICATION OF CASES—RELATIONSHIP OF MINERS' CONSUMPTION TO TUBERCULOSIS.

For convenience, the writer has divided miners' consumption into three stages.[1]

The first stage is characterized by little or no disability, with slight or moderate dyspnea on exertion; the second stage by noticeable disability, with moderate or moderately severe dyspnea; the third stage by total, or at least marked, disability, with severe or urgent dyspnea. This is an entirely arbitrary classification, but one which the writer believes has a considerable practical utility. The inconclusiveness of physical signs made impossible a classification on the basis of actual involvement; also, a classification such as the above is logical in dealing with an occupational disease, where actual disability will ultimately be the basis of relief under laws of compensation and health insurance.

[1] The Miners' Phthisis Commission of South Africa divided victims of that disease into four classes.

Patients in each of the three stages have been further subdivided into tuberculous and nontuberculous. This division is based entirely on the presence or absence of tubercle bacilli in the sputum. Neither symptoms nor signs could be relied on to prove or disprove a tuberculous infection in all cases. Many with tubercle bacilli in their sputum had none of the clinical symptoms of tuberculosis; others with moist râles had no bacilli and no afternoon elevation of temperature.[1]

In this series infection was uncommon in the first stage, frequent in the second stage, and still more so in the third; as the miners' consumption progresses the likelihood of both tubercle and pus infection increases, and it has been the writer's experience that practically no cases die without tubercle bacilli being present in the sputum. Tubercle infection is often a terminal phenomenon of other diseases, but even so its almost constant presence in advanced cases of miners' consumption invests this disease with an additional importance as concerns the public health.

Miners' consumption as observed in southwestern Missouri does not resemble, clinically, ordinary pulmonary tuberculosis; even when tubercle bacilli are present in the sputum, the lack of resemblance is plain and persists until the last few days of life, when, the patient being practically moribund, the resemblance to tuberculosis is more apparent. Some of the symptoms and signs common to tuberculosis are frequently present, yet their proportion when weighed against one another, the patient's appearance, and the large amount of work he is doing prevent us from concluding that the disability, at whatever stage it may be, is largely the result of a tuberculous infection. Throughout there is too much dyspnea to be due to a tubercle infection and still permit the patient, though free from other symptoms, to do a hard day's work; also, were the dyspnea, cough, and sputum due to a tubercle infection, we would expect a rise of temperature in the afternoon, but a temperature record of such cases, still working, failed to show any elevation. The result of roentgenograms is set forth separately.

Usually a tubercle infection implies a more rapid downward progress, an almost hopeless prognosis. It is possible that, up to a certain point, the dust fibrosis may hinder or retard the activity of the tubercle bacillus until a pyogenic infection, or an anemic necrosis, by breaking down the lung tissue, furnishes the tubercle bacillus a more favorable opportunity for development. Occasionally there was observed a patient with evidence of silicosis who also had tubercle bacilli in his sputum and who, nevertheless, looked well and felt well and was able to work on from month to month without any noticeable progress of his disease. Such cases were uncommon; usually

[1] See discussion of tubercle infection below.

once a tuberculous infection is established, or activated, its progress is rapid and its advent signaled by a sudden increase in the severity of the symptoms. Sometimes a tubercle infection will run an acute course; the aggravation of symptoms will be marked; disability will be sudden; and death will ensue in the course of a few weeks or months.

Tuberculosis may be grafted on a miners' consumption either as the result of a direct action of hard rock dust on a previously quiescent tuberculous focus, or by infection from without, the latter being favored by the unusual soil prepared for it. But in any event, the activation of tubercle once accomplished, both local and general constitutional conditions favor speedy development. In other words, looking at the matter from the viewpoint of the generally accepted (international) classification of pulmonary tuberculosis, there is no such thing as the first stage in these cases; when tubercle activity is established the patient is immediately in the far-advanced, or at least moderately advanced, stage. The period of incipiency, if such a phrase is permissible, so often prolonged in ordinary pulmonary tuberculosis, thus becomes a negligible quantity when tubercle infection is grafted on a silicosis. This fact, by reducing the margin of error, tends to make acceptable the classification of tuberculous or nontuberculous by the presence or absence of tubercle bacilli in the sputum.

However, this consideration, while helping to illuminate the status of tubercle infection in miners' consumption, should not allow such infection to overshadow the importance of rock dust. Tubercle infection is secondary in producing disability, though it may hasten death, the silicosis being the primary factor and sufficient to produce these results without the aid of infection.

TABULATION OF RESULTS OF PHYSICAL EXAMINATIONS.

There were 720 miners examined; of these 433 had miners' consumption, 103 also having tubercle bacilli in their sputum. There were 43 cases in which the diagnosis was doubtful, 26 who were suffering from miscellaneous nonpulmonary diseases, and 39 who had an uncomplicated tuberculosis. None of these last three groups are included in the above.

MINERS' CONSUMPTION, FIRST STAGE.[1]

Number of patients, 120; average age, 31; married, 84; single, 36.

AGES, BY 10-YEAR GROUPS.

Under 20	2	40 to 49	10
20 to 29	54	50 to 59	7
30 to 39	48		

[1] In each stage the nontuberculous group is tabulated first, then the tuberculous.

AGES UNDER 21, AT WHICH MINING COMMENCED.

At 12 years	2	At 18 years	6
At 13 years	8	At 19 years	9
At 14 years	2	At 20 years	16
At 15 years	6		
At 16 years	7	Total (57.5 per cent)	69
At 17 years	13		

The remainder commenced mining when over 20 years of age. In this and similar tables ages under 16 usually indicate miners who began their underground work in coal mines.

The average number of years that the men in this group had worked underground (at all kinds of mining, including coal) was 10, while the average number of years' work in sheet-ground (hard rock) was, for 88 men, 5.3 years. Sixteen men had been working in the sheet-ground mines of Jasper County less than a year; of these, 5 had silicosis and 6 anthracosis on arrival, contracted in other mining camps.[1] Six men showed symptoms of rock-dust injury to the lungs, with a history of less than one year's exposure. Fifty-one men averaged 4.5 years on machine drills and 47 men 3.4 years shoveling. One man contracted miners' consumption during 25 years of millwork from exposure to dust set free by the crushers.

Of the 120 men, 115 appeared healthy and 5 looked sick. Following is a tabulation of the various symptoms of the group:

Diminished expansion (noticeable to patient)		40
Loss of weight		25
Hemorrhages (3.3 per cent)		4
Night sweats		2
Pain in chest		79
Front upper half, one side	1	
Front upper half, two sides	9	
Back, lower half, one side	6	
Back, lower half, two sides	7	
Front and back, one side	16	
Various	40	

All of the group had dyspnea on exertion, either mild or moderate in degree. The relationship of dyspnea to cough is shown in the following table:

Dyspnea without cough	29
Dyspnea occurring before cough	48
Dyspnea beginning at same time as cough	11
Cough occurring before dyspnea	8
Doubtful	19

[1] In this investigation the migration of miners was a negligible factor. In most mining camps there is a considerable annual migration, but in the Joplin district the miners are natives and previous to 1915 outsiders had not come in in any large number. The mining other than sheet-ground in these tables was usually "soft-ground" mining in the same district and in southeastern Missouri.

The duration of dyspnea previous to examination was—

1 month	5	1½ years	1
2 months	4	2 years	15
3 months	5	3 years	20
5 months	1	4 years	5
6 months	10	5 years	6
8 months	1	8 years	1
1 year	22	Doubtful	19

Attention is called to the fact that in only 8 cases was there a history of cough antedating dyspnea; also to the wide variation in the previous duration of dyspnea. The only information on the subject was that obtained by questioning the patient; and as the average laboring man is not apt to pay much attention to symptoms until they are fairly troublesome, it is probable that the actual duration of dyspnea was usually longer than recorded. This last table is given mostly as a matter of interest; the duration of symptoms previous to examination, based on the statements of the patients themselves, is too inaccurate to be valuable for statistics. Rather must the stage of miners' consumption and the degree of disability be contrasted with the number of years' exposure to rock dust to establish the duration of the silicosis.[1]

The amount of sputum was considerable in 14 cases, moderate in 12, and little or none for the other 94.

The blood pressures for the group averaged 93–122, taken by the auscultatory method. The following abnormalities were noted:

High systolic pressure, 150 or over	2
Low systolic pressure, 100 or less	5
High diastolic pressure, 110 or over	10
Low pulse pressure, 20 or less	11

There are 8 duplicates in the above, making a total of 20 abnormal blood pressures. Nothing observed in these blood-pressure records could be considered as diagnostic for the group.

Of the 120, 81 had no appreciable physical signs on examination. Weakened breath sounds were noted in 35, as follows:

Over all	7
Over all, more marked one side	2
Over one side	6
Over one side and half of other	2
Over all behind	5
Over one side behind	1
Over upper half, one side	5
Over upper half, one side behind	4
Over one base	3

Dry, sonorous râles were noted in 5 and moist râles in one. The paucity of physical signs in this group is apparent. One hundred

[1] See table, Analysis of deaths.

and eighteen of the 120 were working at the time of examination or until some time within the previous six months.

There were 8 miners in the first stage of miners' consumption with tubercle bacilli in their sputum, not enough for a satisfactory comparison with the nontuberculous group. The average age for the 8 was 28, and all but 1 were married.

AGES BY 10-YEAR GROUPS.

20 to 29	5
30 to 39	2
40 to 49	1

AGES, UNDER 21, AT WHICH MINING COMMENCED.

At 13 years	1	At 17 years	1
At 15 years	1	At 19 years	1
At 16 years	1	Total (62.5 per cent)	5

The average number of years these men had been mining was 7.7 and the average for sheet-ground (hard rock) mining was 4.6 years. Four men had averaged 3.2 years on machine drills and three had averaged 2.6 years shoveling; one man had worked less than a year in sheet-ground.

All of the eight looked healthy; their symptoms were as follows:

Diminished expansion	4
Loss of weight	0
Hemorrhages	0
Nightsweats	0
Pain in chest	4

Cough was absent in four and the duration of their dyspnea was—

3 weeks	1
9 months	1
2 years	2
3 years	2
Doubtful	2

The amount of sputum was moderate in one and very little in the other seven.

The blood pressures for the group averaged 90–117, with the following abnormalities:

High systolic pressure, over 150	1
Low systolic pressure, less than 100	1
Low pulse pressure, less than 20	1

Of the eight, three had no physical signs on examination, four presented weakened breath sounds, with diminished vocal resonance in one case, and one had moderate moist râles at an apex.

All were working at the time of examination and said they felt well. Comparison between the two groups does not give much in-

formation except that the difference in the blood pressure, 5 points lower for the tuberculous group, is suggestive. Contrasting these eight cases with what we would expect to find in a similar number with ordinary pulmonary tuberculosis having tubercle bacilli in their sputum and an evident dyspnea, the difference between the two types of tubercle infection is apparent. None of these eight had evidence of mixed infection, which probably accounts for their apparently good condition aside from dyspnea.

MINERS' CONSUMPTION, SECOND STAGE.

Number of patients, 142; average age, 32.7; married, 112; single, 30.

AGES BY 10-YEAR GROUPS.

20 to 29	55
30 to 39	63
40 to 49	18
50 to 59	5

AGES, UNDER 21, AT WHICH MINING COMMENCED.

At 10 years	1	At 17 years	6
At 12 years	4	At 18 years	6
At 13 years	2	At 19 years	11
At 14 years	6	At 20 years	12
At 15 years	16		
At 16 years	15	Total (55.6 per cent)	79

The average number of years that the men of this group had worked underground was 11.6. One hundred and thirty men averaged 6.7 years in the sheet ground, 9 had worked in sheet ground less than a year, 1 had done only hoisting, and 2 had done only millwork. Seventy-eight men averaged 4.3 years on machine drills, and 71 averaged 4.1 years shoveling.

Of the 142 in the second stage, 5 looked sick and the rest appeared healthy. Their symptoms are tabulated as follows:

Diminished expansion		93
Loss of weight		86
Hemorrhages (10.5 per cent)		15
Night sweats		18
Occasional	14	
Frequent	4	
Dubious history of former night sweats		18
Pain in chest		111
Over all	2	
Over all behind	1	
Over one side	25	
Over both bases	5	
Over one base	9	
Various	69	

Cough was absent in 10, occasional in 48, the remainder having more or less constant morning and evening cough; in 10 cases cough antedated dyspnea. The duration of their dyspnea, which varied from moderate to moderately severe, was—

3 weeks	1	2 years	28
1 month	1	3 years	16
3 months	7	4 years	7
4 months	8	5 years	10
5 months	3	6 years	3
6 months	10	7 years	1
7 months	1	8 years	2
8 months	1	10 years	3
9 months	2	Doubtful	17
1 year	26		

The amount of sputum was moderate in 37, considerable in 35, and little or none in the remaining 70.

The blood pressure in 132 cases averaged 91–118, four points lower than in the first stage. Abnormalities were noted as follows:

High systolic pressure, 150 or over	1
Low systolic pressure, 100 or less	8
High diastolic pressure, 110 or over	11
Low pulse pressure, 20 or less	4
	24

Of the 142, 36 had no appreciable physical signs. Weakened breath sounds were present in 66, as follows:

Over all	32
Over one side	11
Over upper half, both sides	3
Over upper half, one side	2
Over all behind	9
Over both bases	5
Over one base	5
Over apices	1

Nine presented diminished vocal resonance, in seven instances over areas of weakened breath sounds. Although 72 had a moderate or a considerable amount of sputum, moist râles were present in only 16, as follows:

Over all	1
Over one side	1
Over upper half	7
Over lower half	7

Dry râles of various types were present in 14.

Of these 142 men, 133 were working at the time of examination or until within the previous six months.

There were 22 miners in the second stage who also had tubercle bacilli in their sputum. The average age was 31.3; 17 were married and 5 were single.

AGES BY 10-YEAR GROUPS.

Under 20	1
20 to 29	13
30 to 39	4
40 to 49	3
50 to 59	1

AGES, UNDER 21, AT WHICH MINING COMMENCED.

At 11 years	1	At 18 years	3
At 13 years	1	At 19 years	3
At 15 years	1	At 20 years	1
At 16 years	1		
At 17 years	2	Total (59 per cent)	13

The average number of years the men in this group had been mining was 11.4, 20 men had averaged 5.6 years in sheet-ground, and 2 had worked in sheet-ground less than 1 year. On machine drills in sheet-ground 13 men averaged 4.6 years, while 9 men shoveling averaged 3.3 years.

Of the 22 only 1 looked sick; their symptoms were:

Diminished expansion		16
Loss of weight		10
Hemorrhages		1
Nightsweats		1
Pain in chest		15
Over front	2	
Over one side	5	
Over one base	3	
Various	5	

Cough was absent in 1, and in 5 preceded dyspnea. The duration of dyspnea was—

2 weeks	1	1 year	2
3 weeks	1	2 years	2
3 months	1	3 years	1
4 months	3	4 years	1
6 months	1	5 years	2
7 months	1	10 years	1
8 months	1	Doubtful	4

The amount of sputum was considerable in 12 cases, moderate in 5, and very little in 5. The blood pressure for the group averaged 94–123; 2 men were unusually large with blood pressures over 150, which raised the average in such a small number of patients consider-

ably. Leaving out these two high pressures the average was the same as for the nontuberculous group, 91–118.

Physical signs were absent in 1, 12 presented weakened breath sounds, 3 had moist râles, and 5 various dry râles.

All of the 22 were working at the time of examination; comparison of this group with the nontuberculous in the same stage of silicosis fails to show any important points of difference; the symptoms and signs are a little more pronounced.

MINER'S CONSUMPTION, THIRD STAGE.

Number of patients, 68; average age, 37.8; married, 58; single, 10.

AGES, BY 10-YEAR GROUPS.

20 to 29	15
30 to 39	25
40 to 49	19
50 to 59	8
60 to 69	1

AGES, UNDER 21, AT WHICH MINING COMMENCED.

At 10 years	1	At 18 years	4
At 12 years	2	At 19 years	10
At 14 years	4	At 20 years	5
At 15 years	7		
At 16 years	6	Total (60.2 per cent)	41
At 17 years	2		

The average number of years the men in this group had been mining was 15.9, with an average of 8 years in sheet-ground. One had worked in sheet-ground less than 1 year, having probably contracted silicosis before coming to southwestern Missouri, 3 had not worked underground, 2 having done millwork, and 1 having run a hoist. On machine drills in sheet-ground 47 men averaged 6.3 years, and 23 men averaged 5 years shoveling.

Of the 68 men 21 looked sick. Their symptoms were:

Diminished expansion		56
Loss of weight		51
Hemorrhages (20.5 per cent)		15
Night sweats		15
Occasional	10	
Frequent	5	
Dubious history of former night sweats		14
Pain in chest		50
Over one side	14	
Over one base	6	
Over both bases	3	
Over one apex	1	
Over all front	13	
Various	13	

Cough was absent in 3 cases and antedated dyspnea in 8. The duration of dyspnea was:

3 months	1	4 years	8
4 months	2	5 years	2
6 months	3	6 years	2
8 months	1	7 years	1
10 months	3	8 years	2
1 year	13	10 years	1
2 years	19	Doubtful	3
3 years	7		

As mentioned before, the duration of dyspnea is somewhat uncertain and where given in terms of months in this table probably indicates the duration of severe dyspnea; also it was usually impossible to get accurate histories of symptoms dating back several years.

The amount of sputum was unusually large in 5, considerable in 23, moderate in 13, and little or none in 27 cases.

The blood pressures for the group averaged 86–111, 7 points lower than for the second stage and 11 points lower than for the first. The following abnormalities were noted:

High systolic pressure, 150 or over	1
Low systolic pressure, 100 or less	21
High diastolic pressure, 110 or over	2
Low pulse pressure, 20 or less	18

There are 11 duplicates in the last item, leaving 31 abnormal pressures.

Of the 68, 7 had no appreciable physical signs. Abnormal breath sounds were noted as follows:

Weakened breath sounds	14
Weakened breath sounds, with a variety of adventitious sounds	5
Harsh and exaggerated breath sounds	5
Bronchial breathing	4
Bronchial breathing with exaggerated breath sounds	3

Moist râles were noted in 25 cases, as follows:

Scattered over all	3
Over all one side	3
Over front, one side	1
Over apex and upper half other side	3
Over upper half, one side	4
Over upper half, both sides	4
Over upper half, behind	1
Over one base	5
Midscapular region, one side	1

Sonorous and sibilant râles were present in 5.

Of the 68, 46 were working at the time of examination or until within the previous six months.

There were 73 cases of miners' consumption in the third stage with a tuberculous infection. The average age was 36.3; 62 were married and 11 single.

AGES, BY 10-YEAR GROUPS.

20 to 29	15
30 to 39	31
40 to 49	20
50 to 59	7

AGES, UNDER 21, AT WHICH MINING COMMENCED.

At 12 years	1	At 18 years	7
At 13 years	1	At 19 years	6
At 14 years	2	At 20 years	6
At 15 years	4		
At 16 years	3	Total (47.9 per cent)	36
At 17 years	6		

The average number of years that these men had been mining was 14, and the average for sheet-ground mining was 7.7. On machine drills 50 averaged 6 years and 33 averaged 4.2 years shovelling.

Of the 73, 30 appeared sick; symptoms for the group were:

Diminished expansion		65
Loss of weight		59
Hemorrhages (30 per cent)		21
Night sweats		21
Occasional	14	
Frequent	7	
Dubious history of former night sweats		11
Pain in chest		55
Over one side	15	
Over upper half of chest	4	
Over one base	8	
Over both bases	3	
Various	25	

The sputum was unusually large in amount in 16, considerable in 29, and moderate in 18 cases; 9 had very little sputum.

The duration of dyspnea for this group was:

2 months	1	3 years	16
3 months	2	4 years	5
4 months	[illegible]	5 years	3
5 months	1	6 years	1
6 months	4	7 years	1
1 year	13	Doubtful	12
2 years	10		

The blood pressures for the group average 84–109, 2 points lower than for the nontuberculous in the same stage. The following abnormalities were noted:

High systolic pressure, 150 or over	1
Low systolic pressure, 100 or less	23
High diastolic pressure 110 or over	6
Low pulse pressure, 20 or less	28

There were two duplicates in the last item, making a total of 56 abnormal pressures.

Physical signs were noted in this group as follows:

Weakened breath sounds		20
Harsh and exaggerated breath sounds		3
Bronchial breathing		2
Diminished vocal resonance		2
Dry râles of various types		10
Moist râles		31
Over all	2	
Over one side	7	
Over one side and upper half of other	4	
Over one side and front of other	1	
Over one side in front	2	
Over one side behind	1	
Over upper half, one side	3	
Over upper half, behind both sides	1	
Over lower half, both sides	1	
Over lower half, one side	4	
Over one base	1	
Over one base and one side behind	1	
Various patches	3	

It will be noticed that while 63 had sputum in amounts from moderate to very copious, only 31 had moist râles. Of the 73, 48 were working at the time of examination or until within the previous six months.

For comparison the following tables are given, relating to the men who, on examination, were apparently well. There were 179 such (out of 720), the average age being 31.6:

AGES, UNDER 21, AT WHICH MINING COMMENCED.

At 10 years	1	At 17 years	7
At 12 years	4	At 18 years	16
At 13 years	5	At 19 years	9
At 14 years	6	At 20 years	8
At 15 years	13		
At 16 years	12	Total (45.2 per cent)	81

The average number of years these men had mined was 11, while the average for sheet-ground mining was 3.9. Fifty-eight had

worked in sheet-ground less than 1 year, 66 between 1 and 5 years, and 55 men over 5 years, as follows:

5 years	12	11 years	5
6 years	7	12 years	5
7 years	3	13 years	1
8 years	2	14 years	2
9 years	5	15 years	1
10 years	10	16 years	2

The 121 men in the last two groups (those who had worked in sheet-ground more than 1 year) averaged 5.7 years in sheet-ground.

The blood pressures for the well group averaged 95–124, with the following abnormalities:

High systolic pressure ,150 or over	8
Low systolic pressure, 100 or less	2
High diastolic pressure, 110 or over	17
Low pulse pressure, 20 or less	2
	33

SUMMARY OF TABLES.

A summary of the foregoing tables shows a regular progression in the number (percentage) and intensity of both symptoms and signs, from the first stage to the third stage and as between the nontuberculous and the tuberculous in each stage. Attention is called to the average number of years' work in sheet-ground: For the first stage group 5.3, for the second stage group 6.7, and for the third stage group 8 and 7.7, respectively, while the average for the well men was 3.9. Five years' steady work with exposure to flint dust is fairly certain to find the miner in at least the first stage of silicosis; the difference in the degree of dustiness in various mines and the steadiness of work will largely account for individual differences in duration of disease. The figures relative to drilling and shoveling are not very instructive, as the majority of men have done both, often alternating one with the other.

The increasing number of cases with a moderate or large amount of sputum in the second and third stages and the majority of tuberculous infections in the third stage bear witness to the increased tendency to infection that accompanies the progress of a silicosis.

The blood-pressure records show nothing that could be called distinctive of miners' consumption, only a gradual fall accompanying the loss of vitality; the abnormal blood pressures of the well men are nearly all high and those of the sick men mostly low.

The number of miners who commenced to work underground before 21 years of age is noteworthy, more than half in nearly every group. While hard work at an early age necessarily often undermines the vitality, the percentage under 21 among the well men would

indicate that immaturity has little to do with the incidence of miners' consumption, though contributing to the rapidity with which these cases break down.

While the foregoing tables indicate that 60 per cent of those examined had miners' consumption, the actual prevalence of this disease is, of course, less. The total number examined represents about one-fourth of the number of men working in the sheet-ground mines previous to 1915. On this basis 15 per cent of all hard-rock miners in the Joplin district had silicosis, but the writer believes, largely on impressions gained in house-to-house visiting, that the total incidence is at least twice as great. The boom in zinc mining since the start of the European war has resulted in a large number of outsiders coming into the Joplin district, and at present (January, 1916) it is probable that there are more than twice as many miners employed there as formerly, and it is not possible to figure the extent of disease among this number, most of the newcomers being miners from other parts of the country.[1]

ANALYSIS OF FACTS BEARING ON DEATHS.

In a series of house-to-house visits there was obtained a history of 198 deaths from miners' consumption, occurring in 130 families out of a total of 480 families visited. The average age at death of these 198 was 36.7. Their ages, by 10-year groups, were:

20 to 29	52
30 to 39	72
40 to 49	52
50 to 59	18
60 to 69	4

As the only source of information lay in statements of surviving members of the family, no reliable information could be obtained as to the length of illness or duration of disability. Several families gave notable histories: Mrs. C. lost two husbands, aged 32 and 48, one son, aged 28, and one son-in-law, aged 34; Mrs. L. lost four brothers, aged 40, 42, 44, and 40; Mrs. T. lost two brothers, aged 30 and 28, a half brother aged 30, a husband aged 29, and a brother-in-law aged 28. The following table gives a record of 28 cases of miners' consumption who have died since they were examined by the writer:

[1] The Miners' Phthisis Prevention Committee, Union of South Africa, reports (Mar. 15, 1916, p. 14) 26.1 per cent positive cases and 5.5 per cent probable but doubtful in a series of 8,136 examinations of white miners.

Record of 28 cases who died since examination.

Case No.	Age.	Number of years mining.	Number of years in sheet-ground.	Duration of symptoms previous to examination.	Date of examination.	Date of death.	Duration of disability previous to death.	Remarks.
478	35	17	6	1 year.....	Aug. 5, 1915	January, 1916.....	5 months..	These 6 cases were in the third stage of miners' consumption when examined.
567	45	16	4	3 years....	Aug. 31, 1915	November, 1915...	6 months..	
573	39	17	12	1 year.....	Sept. 4, 1915	December, 1915...	11 months.	
654	43	14	9	8 months..	Oct. 5, 1915	November, 1915...	7 months..	
684	30	14	7	3 years....	Nov. 22, 1915	December, 1915...	11 months.	
715	48	20	11	4 years....	Dec. 9, 1915	.....do.....	3 years....	
52	39	16	10	5 years....	May 8, 1915	August, 1915.....	.....do.....	
202	42	20	12	3 years....	May 27, 1915	July, 1915.....	2 years....	
203	41	8	8	6 years....	.....do.....	August, 1915.....	10 months.	
234	50	17	8	? years....	June 1, 1915	September, 1915...	22 months.	
242	40	20	6	3 years....	.....do.....	November, 1915...	2 years....	
272	31	10	10	? years....	June 5, 1915	.....do.....	11 months.	
279	50	7	7	.....do....	June 8, 1915	July, 1915.....	1 year.....	All these 22 cases were in the third stage of miners' consumption when examined and all had tubercle bacilli in their sputum.
285	34	15	10	4 months..	June 9, 1915	August, 1915.....	3 months..	
108	25	10	10	3 weeks...	May 15, 1915	January, 1916.....	? months[1].	
156	31	13	11	6 months..	May 21, 1915	February, 1916....	8 months..	
237	32	12	11	.....do.....	June 1, 1915	January, 1916.....	7 months..	
316	25	3	3	2 years....	June 16, 1915	March, 1916.....	9 months..	
398	33	15	12	3 months..	July 16, 1915	October, 1915.....	6 months..	
411	46	26	9	3 years....	July 20, 1916	February, 1916....	14 months.	
519	40	7	7	10 months.	Aug. 16, 1915	August, 1915.....	1 year.....	
542	27	14	14	1 year.....	Aug. 25, 1915	February, 1916....	4 months..	
556	30	10	10	? years....	Aug. 27, 1915	March, 1916.....	6 months..	
566	37	17	8	1 year.....	Aug. 31, 1915	December, 1915....	...do.....	
578	40	15	5	2 years....	Sept. 13, 1915	January, 1916.....	19 months.	
601	31	10	1½	...do.....	Sept. 16, 1915	March, 1916.....	1½ years...	
652	46	7	7	1 year.....	Oct. 16, 1915	December, 1915...	2 months..	
713	30	16	13	2½ years...	Dec. 8, 1915	.....do.....	1 year.....	

Average age at death..... 37
Average number of years mining..... 13.7
Average number of years sheet-ground..... 8.6
Average number of years disability before death..... 1

[1]Working when examined.

While, as stated before, the record of duration of symptoms is of questionable value, the average of the number of years in sheet-ground, in the foregoing table 8.6, plus the average duration of total disability, 1 year, gives us 9.6 years, which may be taken as the average expectancy of life in a miner with silicosis, dating from the time he commenced hard-rock mining.[1] The figure 8.6 is in accord with the average number of years in sheet-ground for men in the third stage—8 and 7.7. The number of years mining in sheet-ground, as expressed in figures, includes the period of partial disability, as few men, when partially disabled, seek work outside of the mines. We may safely conclude, then, that the average case of miners' consumption dies within 10 years of beginning exposure to silicious dust.

[1] These figures apply to the Joplin district. It is possible that the experience of other mining districts in the United States may differ in this respect.

RELATION OF MINERS' CONSUMPTION TO LIVING CONDITIONS AND TO TUBERCULOUS INFECTION.

While the cause of miners' consumption is found entirely in the underground work of the miners, yet the poor and often wretched conditions under which so many of them live, and the presence of tuberculous foci all combined to reduce their vitality and resistance, on the one hand, and directly to increase their chances of tuberculous infection on the other.

The following quotation from the report of the Miners' Phthisis Committee,[1] is illuminating:

> * * * In 1902–3 a large number of our cases appeared to progress to a fatal issue without clinical or bacteriological evidence of a superadded tuberculous infection. At the present time, however, tuberculosis is certainly found in the large majority of cases in the terminal stage of the disease. There has, undoubtedly, since the date mentioned, been a distinctive alteration in the predominant clinical type of the disease.

We have no data of the status of affairs in the earlier days of mining in southwestern Missouri, but it is reasonable to suppose that there has been a similar progress of events there. In other words, as the country has become more and more settled, and as foci of tuberculous infection have become more widespread, the chances for any given case of miners' consumption to remain uninfected is less and less; at present, owing largely to the unhygienic living conditions and the carelessness of the miners themselves, we have the results set forth in the tables above, namely, a preponderance of tuberculous infection in the third stage, and with such infection almost inevitable before death.

As far as housing is concerned, the danger lies in the crowding and intimate contact of members of the family. Small three and four room shacks are very common; and aside from any question of ventilation or hygienic precautions on the part of the tuberculous, such intimate contact is sufficient to insure the spread of tuberculous infection among both the miners and their children.

There has not been observed among the women in miners' families much tuberculous infection which could be charged to infection among the men. Missouri was included in the registration area too recently for its vital statistics to be of much value on such a point, but the general opinion of doctors, nurses, and others who come into contact with the people is as stated. While this opinion probably underestimates the real condition of affairs, the short period during which many cases of miners' consumption emit tubercle bacilli before their death would seem to explain this apparent lack of infection of the wives. However, this danger, while it may be

[1] Union of South Africa, Capetown, 1912, p. 8, par. 10.

minimal for adults, is a serious matter as far as children are concerned. In order to arrive at some idea of the amount of tuberculous infection among children, an examination of school children, to the number of 2,506, was made in the town of X, in the sheet-ground district. Attention was paid to those under weight or too slender for their height or otherwise undersized. The following table shows the results:

Ages.	Number.	Under size or weight.	Per cent.
Under 10:			
Boys, miners	299	38	12.7
Boys, nonminers	317	49	15.4
Girls, miners	274	25	9.1
Girls, nonminers	297	18	.6
10 to 15:			
Boys, miners	272	72	26.4
Boys, nonminers	239	52	21.7
Girls, miners	221	25	11.3
Girls, nonminers	333	34	10.2
Over 15:			
Boys, miners	23	4	17.3
Boys, nonminers	83	4	4.8
Girls, miners	31	1	3.2
Girls, nonminers	117	1	.8

For comparison, the children were divided into those of miners' families and those of nonminers' families. It was possible to secure only 64 of the above for thorough physical examination; this showed 14 of the 64 to be tuberculous and 10 probably tuberculous; these 24 were almost all miners' children, and in the majority of cases the father had suffered from miners' consumption or had possibly died of it.

While these data may not indicate very much tuberculous infection of miners' children, yet we can logically expect, unless precautions are taken, that tuberculous infection will become more and more menacing to public health in the Joplin district. This implies increased danger to adults and to children, with tuberculous infection in miners' consumption occurring more frequently in the first and second stages and earlier in the third stage, and consequently directly affecting the safety of the children.

There becomes apparent, therefore, as a matter of paramount importance to the welfare of the community, a necessity of educating the miner to guard against the possible spread of infection, and of controlling children by medical inspection in the schools and by adequate visiting-nurse service, with facilities for examining children, especially of known consumptive parents. As the writer has had occasion to point out elsewhere, miners' consumption should be treated with the same hygienic precautions as is pulmonary tuberculosis, as there is no telling in any given case when infection may take place and tubercle bacilli appear in the sputum.

CONCLUSIONS.

1. Miners' consumption is an important occupational disease, widely prevalent among the hard-rock miners of the Joplin district, affecting probably 30 to 35 per cent of them.

2. Miners' consumption is essentially a pneumonoconiosis, due to the inhalation of silicious rock dust, and resulting in a fibrosis, with loss of function.

3. The disability and other effects of miners' consumption are due primarily to silicosis, infection being usually a secondary, and often a terminal, process.

4. Infection, both tuberculous and pyogenic, is common in miners' consumption, the tendency to infection increasing as the disease progresses.

5. The incidence of tubercle infection in miners' consumption is a menace to the public health, affording an unusual opportunity for the spread of tuberculosis.

6. Aside from the hygienic supervision of working conditions underground, education of the miner against the spread of infection and supervision of miners' children, especially those of consumptive parents, are matters of vital importance.

ROENTGEN-RAY FINDINGS IN MINERS' CONSUMPTION, BASED UPON A STUDY OF 150 CASES.

By SAMUEL B. CHILDS, M. D.

The larger number of the roentgenograms upon which this study is based were made by Dr. Dumbauld, of Webb City, Mo. They were made with the patient supine, at the end of a full inspiration, and the anodal distance from the plates was 25 to 30 inches. These plates were brought to Denver by Dr. Lanza, who requested the writer's assistance in their interpretation. The remainder of the roentgenograms are from the writer's collection, and in this series the patient's position was prone, the other conditions being the same as those just mentioned. In the majority of cases the stereoscopic method was employed.

The writer expresses his appreciation to Dr. Lanza and Dr. Dumbauld for the opportunity of studying so many cases of miners' consumption, especially those in a comparatively early stage. The reproductions in this article have been selected to represent the progressive changes in the course of this disease. In the reproduction of a chest roentgenogram, many of the finer deposits and secondary lung changes are often not shown clearly, although they are easily detected upon the original negative, hence the description of each reproduction in this article is taken from the original negative.

In an article by Dr. Sewall, of Denver, in conjunction with the writer, which appeared in the Archives of Internal Medicine for July, 1912, an attempt was made to interpret the shadows found upon a roentgenogram of both the normal and tuberculous chest, based upon a study of 100 consecutive cases. Added experience has tended to confirm the correctness of the aforesaid interpretations, so that it does not seem necessary, in this study, to explain in detail the cause of the ordinarily accepted chest shadows. We shall endeavor to mention the changes in the cases under our observation which denote the earliest deviation from the normal shadows caused by the inspiration of rock, coal, or metal dust, and to trace the course of the disease in its several stages, contrasting these changes with those found in similar stages of tuberculosis.

As tuberculosis is ordinarily divided into three stages, it seems best arbitrarily to divide miners' consumption into three stages for the sake of comparison.

FIRST STAGE.

The changes that are regarded as characteristic of the first stage of miner's consumption are the secondary changes in the shadow cast by the root of each lung and that cast by the radiating branches of the bronchial tree, and are caused by the fibrosis which is established as the result of continued irritation of the bronchi from the inspiration of dust particles encountered in mine work.

These changes are represented by increased density and breadth of the shadow of the walls of the bronchi of each lung and by the shadows of numerous punctate deposits of varying size in the line of the thick-walled bronchi. The root shadows are more voluminous and denser than normal and frequently contain the still denser shadows of nodular deposits. This pathological process is very often symmetrical in both lungs and closely resembles the peribronchial thickening found in the bronchial type of tuberculosis. In fact, without the aid of a clinical history the writer believes that it is practically impossible, in many cases, from the roentgenograms alone to distinguish between the early peribronchial fibrosis of miner's consumption and that caused by bilateral bronchial tuberculosis. Certain points of difference sufficient to differentiate the two diseases, however, are often observed upon the roentgenogram.

In bronchial tuberculosis we find more "stippling" or fine deposits in the extreme apices than in miners' consumption, and the shadows cast by a few calcareous nodules, possibly by only one, in some part of the lung, in addition to the fibrosis, are mute evidence of the scars of a healed tuberculous focus, and are sufficient often to distinguish the two diseases. As a rule in bronchial tuberculosis there is not the extensive symmetrical fibrosis nor the dense bronchial wall shadows that are characteristic of the first stage of miner's consumption. In bronchial tuberculosis the amount of fibrosis is often more extensive in one lung than in the other, as shown by the difference in density and breadth of the bronchial wall shadows, indicating that the less dense shadows probably denote a more recent infection or one in which the preparative fibrosis is only partially established.

In bronchial tuberculosis attacks of pleurisy are not infrequent and we can often demonstrate on the roentgenogram patches of thickened pleura or pleuritic bands which, in addition to the fibrosis, exert a sufficient pull to displace the trachea or the heart from their normal position, or occasion a restricted or delayed range of motion to one side of the diaphragm. In the early stage of miner's consumption, on the contrary, we have been unable to demonstrate any appreciable displacement of the trachea or heart or notice any difference on the excursion of the diaphragm on either side.

SECOND STAGE.

In addition to the fibrosis above described, which exists in the first stage, there is distributed throughout each lung in a fairly symmetrical manner, both as to size and location, a large number of circumscribed dense areas in which the miners' dust has found lodgment. As the disease advances, there accumulates in certain portions of each lung larger masses of deposits than in others, and there seems to be no general rule applicable to all cases for the location of these large deposits, a fact which apparently is determined by some idiosyncrasy or local lessened resistance peculiar to the individual. The most frequent site that we have observed for these large deposits, however, is in the lower part of the upper third of each lung, about the level of the root shadow, nearly equidistant from back and chest wall and vertically midway of chest. On the other hand, no part of the lung seems to be exempt from these massive deposits, but the upper half of each lung is the most frequently involved; occasionally the arrangement of the fibrosis and deposits is not symmetrical in both lungs, but every case in our series shows bilateral involvement, and the pathological shadows in one lung are practically of the same density as those in the other, indicating that the inception of the pathology probably occurred at or about the same period of time in each lung.

In the second stage of tuberculosis the symmetrical arrangement of dense masses in each lung in the location just described is rarely found, and the masses when present in either lung do not have as well defined an outline, being generally either partially or wholly obscured by the shadow of thickened pleura, adhesive bands, or irregularly distributed bands of fibrosis, and in this stage there frequently is evidence of beginning cavity formation. The heart and trachea are generally both displaced and the excursion of the diaphragm is limited, whereas, in miners' consumption in the second stage, cavitation practically never occurs unless a tuberculous infection has already become established; the outline of the large deposits is more sharply defined and is either of uniform density or of greatest central density, diminishing in intensity to the periphery, the heart and trachea are not displaced and the dome of the diaphragm appears accentuated, due to the increased depth of the external angle between the diaphragm and chest wall.

THIRD STAGE.

The appearance of the third stage of miner's consumption differs very little from that of the second stage, except in the greater extent of lung involvement, as indicated by an increased number of deposits and more massive grouping of the circumscribed areas of

dense shadows, often to such an extent that it is impossible to find any portion of the area of the involved lung that appears free from the shadows which characterize the final stage of the disease. The position of the heart shows but slight if any deviation from the normal. The angle between the diaphragm and chest wall is deepened markedly in inspiration, and the domelike appearance of the diaphragm is still more accentuated than in the second stage.

The diminished rib spacing in the middle third of the chest upon a full inspiration, which begins to be apparent in the second stage, is still narrower in the third stage, while the spacings between the lower ribs are increased.

Cavity and abscess formation are not infrequently detected in the third stage, but this condition is regarded as the result of an engrafted tuberculous or pyogenic infection. When this change has taken place we find evidence of adhesive bands, heart and tracheal displacement, restricted motion of the diaphragm, in fact many of the typical appearances that are characteristic of the third stage of tuberculosis.

In the third stage of tuberculosis cavitation can practically always be detected and the changes in the lungs are characterized by areas of varying density, interpreted as indicating the difference between the old and more recent areas of involvement, and the secondary changes incident thereto. In this stage marked heart and tracheal displacement are apparent with limited movement of the diaphragm.

The heart in miner's consumption casts a larger shadow than normal, and in the early stages is probably caused by its increased musculature from heavy work. The shadow of the heart remains larger than normal in the second and also in the third stage. In tuberculosis, on the contrary, the heart shadow is smaller than normal, especially in the second and third stages.

Fig. 1.—First stage silicosis; hard rock miner off and on for 15 years. Comparatively small amount of fibrosis and general absence of deposits with the exception of those in the right root.

Fig. 2.—First stage silicosis; coal miner 2 years, hard rock 4 years. Bilateral fibrosis with deposits in each lung along lines of radiation. Hardly any sputum, but tubercle bacilli appeared in sputum soon after plate was made.

Fig. 3.—No. 59, first stage silicosis. Shadows relatively larger than normal, bringing out the bronchial fibrosis which exists bilaterally. Thickening and deposits at left root. No tuberculosis.

Fig. 4.—First stage silicosis. Bronchial fibrosis with thickening about right root; also accentuated dome right diaphragm. Sputum scanty.

Fig. 5.—First stage silicosis; hard rock miner 9 years. More extensive fibrosis and deposits on right than left, but in the latter the thickening about root is more apparent. No evidence of cavitation. Tubercle bacilli present in sputum.

Fig. 6.—Second stage silicosis; hard rock miner 16 years. Note extensive fibrosis with small deposits lower half each lung; also diminished spacing of ribs on right side. No tuberculosis demonstrable clinically.

Fig. 7.—Second stage silicosis; hard rock miner for 4 years. Bronchial fibrosis with discrete deposits in each lung. Note dense shadow of left root. No tuberculosis demonstrable clinically.

Fig. 8.—Second stage silicosis; hard rock miner for 20 years off and on. Characteristic bilateral arrangement of shadows cast by deposits. Very little sputum and no tuberculosis demonstrable clinically.

Fig. 9.—Second stage silicosis; this case was a millman who had never worked underground, but had worked in a mill (crusher house) for 25 years. Large deposits about root of each lung; note typical appearance of diaphragm on full inspiration. Sputum scanty, and no tuberculosis demonstrable clinically.

Fig. 10.—Second stage silicosis; hard rock miner 11 years. Symmetrical shadows in each lung, with thickening about each root. Very little sputum and no tuberculosis demonstrable clinically.

Fig. 11.—Third stage silicosis; hard rock miner for 18 years. Extensive large masses about midway of chest in upper third each lung, also other deposits distributed in lower half right lung and middle third of left. Evidence of cavitation right apex. Considerable sputum with tubercle bacilli present.

Fig. 12.—Third stage silicosis; hard rock miner 25 years off and on. Note extensive massive deposits in each lung; also adhesions of diaphragm. This man was the picture of robust health and had practically no symptoms aside from severe dyspnea. Was in sanatorium 6 months, where no tuberculosis could be demonstrated.

Fig. 13.—Third stage silicosis; hard rock miner for 20 years. Note extensive deposits throughout each lung, with two large circumscribed deposits just above root of each lung. Had coughed for 5 years, no tuberculosis demonstrable clinically.

Fig. 14.—Advanced third stage silicosis, without cavitation; hard rock miner for 13 years. Note extensive massive deposits occupying more than half of each lung. Note characteristic appearance of diaphragm found with this extensive amount of involvement; also increased spacing lower ribs with diminished spacing of upper.

Fig. 15.—Third stage silicosis, with tuberculosis; hard rock miner for 16 years. Extensive deposits upper half of each lung with cavitation; adhesive pleuritic bands accounting for the cone-shaped elevation of the diaphragm; diminished spacing of the ribs in mid-chest.

Fig. 16.—This is a case of anthracosis in a miner who had worked 18 years in coal mines. Extensive bilateral deposits throughout each lung, and marked thickening about each root.

APPENDIX.

CASES TYPICAL OF THE VARIOUS GROUPS OF MINERS' CONSUMPTION.

The following cases are selected as being typical of the various groups to which they belong:

No. 522, age 36, single, mining for 10 years, in sheet ground 7 years, machineman 4 years and shoveler 3; previous history negative. Appearance healthy, weight 146, normal; has been coughing off and on for 5 years and has had dyspnea for 2 years, moderate; no hemorrhages, no night sweats, no chest pains; expansion diminished. Pulse 72, blood pressure 90–120; a good deal of sputum at present. Examination reveals nothing, the chest appears clear. Diagnosis—miner's consumption, first stage.

No. 83, age 30, mining for 6 years, all in sheet ground, shoveling all the time; pneumonia 9 years ago. Appearance healthy, weight 150, normal; is moderately dyspneic for past year with only an occasional cough; no hemorrhages, no night sweats, pain in chest at left base; expansion diminished. Pulse 76, blood pressure 96–130; a little sputum at times. Examination shows weakened breath sounds all over chest, nothing else. Diagnosis—miner's consumption, first stage. Examined 7 months later, weight 155, cough and dyspnea somewhat increased. Was working steadily all the time, averaging about fifty 1,250-pound cans of ore a day—a first-class shoveler.

No. 173, age 33, mining for 10 years, 5 years in sheet ground on machine; typhoid 7 years ago. Appearance healthy, weight 165, normal; has been dyspneic for 2 years, now moderate, and has been coughing for a year, loses his breakfast; no hemorrhages, no night sweats, pain all over back of chest, expansion diminished. Pulse 68, blood pressure 80–122; a little sputum at times. Examination shows diminished vocal resonance right apex, both apices being impaired on percussion. Diagnosis—miner's consumption, first stage.

The sputum of these three cases was negative for tubercle bacilli.

No. 266, age 27, mining 12 years, off and on, 4 years in sheet ground on machine; diphtheria 7 years ago, grippe 3 weeks ago; appearance healthy, weight 145, normal; has been slightly dyspneic for several years, has been coughing since the grippe; no hemorrhages, no night sweats, pain over left side chest, expansion diminished. Pulse 80, blood pressure 100–120. Examination, chest slightly impaired on percussion over all, expansion greater right; breath sounds weakened behind on right; breath sounds almost inaudible upper half, left side, behind, with vocal resonance hardly perceptible over same area. A little sputum at times, but positive for tubercle bacilli. Diagnosis—miner's consumption, first stage, with a tubercle infection. This man was the picture of health, working hard all the time; his "grippe," 3 weeks ago, probably marked the activation of a tubercle infection in the dust-injured lungs.

No. 289, age 29, mining for 5 years at irregular intervals; in sheet ground 5 years, on machine 2; typhoid 17 years ago. Appearance healthy, weight 165, normal; has been moderately dyspneic for 9 months, no cough; no hemorrhages,

no night sweats, various pains in chest; expansion diminished; pulse 72, blood pressure 92–116; very little sputum at any time, but positive for tubercle bacilli. Examination reveals nothing. Diagnosis—miners' consumption, first stage, with a tubercle infection. Examined 3 months later. Had been ill; weight went down to 149, but now 162. Has had a little morning cough, dyspnea about same; spit a little blood twice. Is working steadily.

Tubercle infection in these two cases is probably recent; the small amount of sputum would indicate no mixed infection, which would account for their comparatively good condition. The after progress of these cases is not known.

No. 600, age 38, mining 22 years, 9 years in sheet ground, on machine 7, and shoveling 2; pneumonia as a child. Appearance healthy, weight 164, should weigh 180; has been dyspneic for 15 months, now moderately severe, and has been coughing off and on for 1 year; no hemorrhages; no night sweats; pains over front of chest; expansion diminished. Pulse 72 blood pressure 100–120; a good deal of sputum. Examination reveals nothing. Diagnosis—miners' consumption, second stage. This man laid off a while and then went back to work underground, driving a mule. A temperature record over 5 days failed to show any rise of temperature in the evening.

No. 524, age 25, mining for 7 years, all sheet ground, machine 3 years, and shoveling 4; pneumonia 11 years ago. Appearance healthy, weighs 150, should weigh 165; has been dyspneic for at least 7 months, now severe; has had a morning cough for 3 months, and loses his breakfast; no hemorrhages; no night sweats; pains over front of chest; expansion diminished. Pulse 68, blood pressure 100–130; a moderate amount of sputum, negative for tubercle bacilli, but showing flint dust. Examination shows breath sounds weak over all, especially behind. Diagnosis—miners' consumption, second stage. This man used to shovel about seventy-five 1,000-pound cans of ore daily, can now shovel only 35 or 40. He got a lighter job underground, and 2 months after examination there was a slight improvement in symptoms. A temperature record taken 4 months after examination failed to show any rise of temperature in the evening.

No. 656, age 38, mining 16 years, 7 years in sheet ground, mostly on machine drills; previous history, negative. Appearance healthy, weight 135, should weigh 145; has been dyspneic for 10 years, now moderately severe, and has been coughing off and on for 8 years; no hemorrhages; no night sweats; pain over left side of chest formerly; expansion diminished. Pulse 84, blood pressure 86–128; a small amount of blue sputum. Examination shows retraction of the apices, with weakened breath sounds over all, especially upper half behind; vocal resonance is diminished over all. Diagnosis—miners' consumption, second stage. This man had not worked underground for 9 years but around mine engine rooms and running mine hoists; he stated that from year to year his dyspnea was increasing and his weight decreasing. Was seen 2 months after examination running mine hoist and feeling well, except for his dyspnea. A temperature record at this time failed to show any rise of temperature in the evening.

No. 399, age 40, had been working 15 years in mills of sheet-ground mines; typhoid at 18. Appearance healthy, weight 170, about normal; has been dyspneic for a year and a half, now severe, and has been coughing slightly for same time; no hemorrhages; no night sweats; various pains in the chest; expansion diminished. Pulse 72, blood pressure 70–94; very little sputum. Examination shows apices dull on percussion, with weakened breath sounds

behind on the right side and over all on the left. Diagnosis—miners' consumption, second stage. This man quit work a year previous and went to the State tuberculosis sanitarium. While there, never had any elevation of temperature, nor were tubercle bacilli ever found in his sputum, over a stay of 7 months. An example of miners' consumption contracted outside of underground work.

No. 135, age 34, mining for 24 years, 11 years in sheet ground; machine man all the time; typhoid and pneumonia as a child. Appearance healthy, weight 125, should weigh 150; dyspnea for the past 5 years, now moderate, and cough for 5 years, mostly in the morning; no hemorrhages; no night sweats; no chest pains; expansion diminished. Pulse 72, blood pressure 66–96; very little sputum at any time. Examination showed squeaky râles over front, right side, with greatly weakened breath sounds same side behind; breath sounds are weak left side behind and absent over left base. Diagnosis—miners' consumption, second stage. This man was working up to the time of his examination and was in the habit of vomiting his breakfast.

No. 479, age 25, mining for 10 years, 7 years in sheet ground, 3 on machine, and 4 shoveling; previous history negative. Appearance healthy, weight 145, should weigh 160; dyspneic for the past 5 years, now moderately severe; has coughed for 3 years; loses breakfast; no hemorrhages; no night sweats; pains over front of chest; expansion diminished. Pulse 84, blood pressure 82–114, a considerable amount of sputum, negative for tubercle bacilli. Examination shows weakened breath sounds over the right side. Diagnosis—miners' consumption, second stage. Four months later was still working, temperature record showing no evening temperature, but obviously going down hill. (All temperatures were taken between hours 4 and 5 p. m. in all cases.)

No. 571, age 27, mining 12 years, 8 years in sheet ground; previous history negative. Appearance healthy, weight 170, normal; has been dyspneic for past 3 years, now moderate, and has coughed off and on for 3 years; had several hemorrhages, quantity unknown, about 6 months ago; has night sweats more or less frequently, no chest pains; expansion diminished. Pulse 64, blood pressure 80–108; a considerable amount of sputum. Examination shows weakened breath sounds all over chest. Diagnosis—miners' consumption, second stage. While the night sweats and large amount of sputum point to infection in this case, there were no moist râles.

No. 623, age 43, mining for 20 years, off and on, and 12 years in sheet ground; typhoid 23 years ago. Appearance healthy, though thin; weight 122; should weigh 165, the loss having occurred in 2 years' time; has had dyspnea for a year and a half, now severe; no cough; 8 small hemorrhages in the past year; no night sweats; pain over front of chest; expansion diminished. Pulse 84, blood pressure 98–120; a moderate amount of sputum, negative for tubercle bacilli. Examination shows roughened breath sounds at right apex and weakened breath sounds upper third, behind, on left side. Diagnosis—miners' consumption, second stage. Is working steadily all the time.

No. 14, age 29, mining 12 years, 2 years in sheet ground (had done hard-rock mining elsewhere); previous history negative. Appearance healthy, weight 163, about normal; has been dyspneic for 5 years, now severe, and has been coughing for 3 years; no hemorrhages; no night sweats (dubious history of night sweats a year ago); various pains in chest; expansion diminished. Pulse 94, blood pressure 90–128; a small amount of sputum, positive for tubercle bacilli. Examination shows apices and bases impaired on percussion and weakened breath sounds over both bases, behind. Diagnosis—miners' consumption, second stage, with a tubercle infection. Condition apparently unchanged 7 months later, working all the time. This man has had 2 wives die of pulmonary tuberculosis and his present wife has tuberculosis.

No. 132, age 38, mining for 8 years, all sheet ground, on machine and shoveling about half the time; typhoid 15 years ago. Appearance healthy, weight 145, normal; has been dyspneic for an indefinite time, severe for 4 months; has been coughing for a year and a half; loses breakfast; no hemorrhages; no chest pains; a few night sweats 2 months ago; expansion diminished. Pulse 80, blood pressure 92–122; a considerable amount of sputum, positive for tubercle bacilli. Examination shows moderately coarse moist râles, on cough, left base, behind, with diminished vocal resonance same area. Diagnosis—miners' consumption, second stage, with a tubercle infection.

No. 639, age 21, mining 4 years, all sheet ground, on machine 2 years and shoveling 2 years; smallpox 7 years ago. Appearance healthy, weight 120, normal 135; dypsneic for an indefinite time, severe for 4 months, now urgent; coughing for 3 months, now severe; no hemorrhages; occasional night sweats (frequent 9 months ago); pain over front of chest; expansion diminished. Pulse 88, blood pressure 100–128; very little sputum. Examination shows dull apex, left, with expansion better, right side. Breath sounds are weak upper half of chest, especially right side, behind. Diagnosis—miners' consumption, third stage. Six months ago this man was shoveling forty-five 1,250-pound cans of ore a day. Was seen 3 months after examination, still working, but hardly able to get around; is driving mule. Temperature record at this time fails to show any elevation above normal.

No. 557, age 48, mining 16 years, 2½ years in sheet ground; has had malaria. Appearance thin, weight 125, should weigh 150; has been dyspneic for 4 years, increasing all the time and now severe; very little cough; no hemorrhages; no night sweats; no chest pains; diminished expansion. Pulse 84, blood pressure 76–90; very little sputum. Examination shows right apex dull and expansion better left. On the right side, bronchial breathing apex and weakened breath sounds over all; left side, loud sonorous râles all over front, bronchial breathing upper half behind. Diagnosis—miners' consumption, third stage. This man has been idle 4 years; he feels well, looks well, eats and sleeps well, but is so dyspneic on exertion he is unable to do any work. Temperature record does not show any elevation.

No. 96, age 64, mining for 29 years, 9 years in sheet ground, shoveling; previous history negative. Appearance healthy, weight 150, should weigh 170; dyspnea duration uncertain; severe for 2 years, and now urgent; severe cough for 2 years; no hemorrhages; no night sweats; pain right base; diminished expansion. Pulse 120, blood pressure 68–86; a large amount of sputum, negative for tubercle bacilli. Examination shows chest dull on percussion, upper half and impaired remainder; right side, coarse moist râles, increased on cough, upper third, harsh breath sounds remainder; left side, coarse moist râles apex, harsh breath sounds remainder. Diagnosis—miners' consumption, third stage. Has been unable to work for 2 years and is very sick. Was seen 4 months after examination, dyspnea worse and is going down hill. Temperature record shows slight elevation (2/10) occasionally.

No. 72, age 28, mining for 8 years, all sheet ground, and on machine half the time; pneumonia 5 months ago. Appearance healthy; weight 126, should weigh 145; dyspnea, severe, for past year; coughs occasionally, no hemorrhages; night sweats formerly; various pains in chest; diminished expansion. Pulse 100, blood pressure 74–118, very little sputum, negative for tubercle bacilli. Examination shows left apex impaired on percussion; some fine moist râles, on cough, right apex; bronchial breathing, whispered pectoriloquy left apex, moist râles of midscapular left side. Diagnosis—miner's consumption, third stage. Examined 3 months later; weight 120, no cough, dyspnea increased, is having night sweats; is working steadily in spite of his severe dyspnea; 7 months after

examination has a lighter job, is feeling somewhat better; temperature record at this time shows no elevation.

No. 713, age 30, mining 16 years, in sheet ground 13 years, mostly machine drilling; smallpox 2 years ago. Appearance sick, weight 126, should weigh 145; has been dyspneic for 2 years, now urgent; coughing for 2½ years, now severe; no hemorrhages, no night sweats, no chest pains; diminished expansion. Pulse 128, blood pressure 64–82; a considerable amount of slaty-blue sputum, positive for tubercle bacilli. Examination shows a large variety of adventitious sounds, groans, wheezes, rattles, and whistling noises all over chest. Diagnosis—miner's consumption, third stage, with n tubercle infection. Patient has not worked for a year; died 8 days after examination.

No. 519, age 40, mining for 7 years, all sheet ground, on machine 3 years; pneumonia 20 years ago and 1 year ago. Appearance sick, weight 118, should weigh 138; has been dyspneic a long time, severe for past 8 months; has had a moderate cough for 10 months; no night sweats, no hemorrhages, no pain in chest; expansion diminished. Pulse 112, blood pressure 70–90; a large amount of blue sputum, positive for tubercle bacilli. Examination shows chest dull on percussion, upper half and impaired remainder; moist râles and squeaks all over right side; amphoric breathing left apex, coarse moist râles over left front. Diagnosis—miner's consumption, third stage, with tubercle infection. Patient had been unable to work for 1 year and died 2 weeks after examination.

No. 258, age 23, mining 8 years, all sheet ground and on machine; typhoid 7 years ago. Appearance healthy, weight 167, normal; has been dyspneic 3 years, now severe; has had an evening cough for 7 months; frequent night sweats, lately; no hemorrhages; pain over left side of chest; diminished expansion. Pulse 88, blood pressure 84–110; a moderate amount of sputum positive for tubercle bacilli. Examination shows slight impairment on percussion over all chest; breath sounds are inaudible upper half behind, both sides, and very weak lower half; vocal resonance almost inaudible behind, except over bases. Diagnosis—miner's consumption, third stage, with tubercle infection. Patient quit work 2 months ago, but has since resumed.

No. 492, age 37, mining 12 years, 7 years in sheet ground, 5 years on machine and 2 years shoveling; previous history negative. Appearance healthy, weight 121, should weigh 135; dyspneic for 8 or 10 years, moderately severe past 4 years; has had a severe morning cough for 9 months; no hemorrhages, no night sweats, no chest pains; diminished expansion. Pulse 96, blood pressure 110–132; a considerable amount of blue sputum, positive for tubercle bacilli. Examination shows cavernous breathing and clicking râles right apex; bronchial breathing left apex, moist râles scattered over left side. Diagnosis—miner's consumption, third stage, with tubercle infection. This man had not worked underground for 8 years, following the carpenter's trade, yet he was still expectorating blue sputum, and his dyspnea was increasing from year to year. He died of pulmonary hemorrhage 9 days after being examined.

No. 361, age 35, mining 11 years, all machine work in sheet ground; malaria 2 years ago. Appearance healthy, weight 175, should weigh 200; has been dyspneic for 2 years, now severe, and has coughed for 2 years, now severe in the morning; night sweats 2 years ago, no hemorrhages, various pains in chest; diminished expansion. Pulse 120, blood pressure 90–114; moderate amount of sputum, positive for tubercle bacilli. Examination shows dull apex, right side, and impaired over all; expansion better left; breath sounds somewhat weak, left side. Diagnosis—miner's consumption, third stage, with tubercle infection. Quit work 2 months ago.

RELATED PUBLICATIONS.

[Literature bearing upon the subject of vocational diseases issued by the Public Health Service, from which copies may be obtained without charge.]

PUBLIC HEALTH BULLETINS:

No. 71. Studies in Vocational Diseases. I. The Health of Garment Workers. By J. W. Schereschewsky. II. The Hygienic Conditions of Illumination in Workshops of the Women's Garment Industry. By J. W. Schereschewsky and D. H. Tuck. August, 1915.

No. 73. Tuberculosis Among Industrial Workers: Report of an Investigation Made in Cincinnati, with Special Reference to Predisposing Causes. By D. E. Robinson and J. G. Wilson. April, 1916.

No. 76. Health Insurance: Its Relation to the Public Health. By B. S. Warren and Edgar Sydenstricker. March, 1916.

No. 78. Influence of Occupation on Health during Adolescence. Report of a physical examination of 679 male minors under 18 in the cotton industries of Massachusetts. By M. Victor Safford.

No. 81. Studies in Vocation Diseases. The Effect of Gas-Heated Appliances Upon the Air of Workshops. By Charles Weisman. September, 1916.

No. 85. Miners' Consumption. A study of 433 cases of the disease among zinc miners in southwestern Missouri. By A. J. Lanza. With a Chapter on Roentgen Ray Findings in Miners' Consumption. By Dr. Samuel B. Childs.

REPRINTS FROM THE PUBLIC HEALTH REPORTS:

No. 195. Industrial Conditions. Their Relations to the Public Health. By B. S. Warren. May 29, 1914.

No. 197. Industrial Insurance. Medical Examination of Employees and Prevention of Sickness its Proper Function. By J. W. Schereschewsky. June 5, 1914.

No. 234. Physical Examination of Workers. By J. W. Schereschewsky. November 20, 1914.

No. 250. Sickness Insurance: Its Relation to Public Health and the Common Welfare. By B. S. Warren. January 8, 1915.

No. 302. Industrial Hygiene. A Plan for Education in the Avoidance of Occupational Diseases and Injuries. By J. W. Schereschewsky. October 1, 1915.

No. 335. Statistics of Disability. A Compilation of Some of the Data Available in the United States. By B. S. Warren and Edgar Sydenstricker. April 21, 1916.

SUPPLEMENT TO THE PUBLIC HEALTH REPORTS:

No. 17. Sanitary Survey of Indiana Industries Employing Woman Labor. By M. J. White. July 17, 1914.

○

The City Library
Springfield, Mass.

MED. LIB.
614
458&
No. 86

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 86
AUGUST, 1917

INVESTIGATION OF THE POLLUTION OF CERTAIN TIDAL WATERS OF NEW JERSEY, NEW YORK, AND DELAWARE

WITH SPECIAL REFERENCE TO

BATHING BEACHES AND SHELLFISH-BEARING AREAS

By

HUGH S. CUMMING

PREPARED BY DIRECTION OF THE SURGEON GENERAL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
20 CENTS PER COPY

TABLE OF CONTENTS.

	Page.
Introduction	7
Scope and methods of investigation	8
Form of studies	8
Technique of collection and examination of samples	8
Floats	9
Raritan Bay and vicinity	10
General view of area	10
Description	10
Shellfish areas	11
New York side	11
New Jersey side	12
Scope of studies	13
Raritan River	13
Sanitary survey	13
Bacteriological results	16
Arthur Kill	16
Sanitary survey	16
Bacteriological and dissolved oxygen results	18
Conclusions	18
Western portion of Raritan Bay	18
Sanitary survey	18
Float tests	18
Factors in pollution of area	20
Bacteriological results	20
Conclusions	21
Eastern portion of Raritan Bay and Lower New York Bay	21
Sanitary survey	21
Tides and currents	21
Staten Island Flats	24
Bacteriological results	24
Conclusions	26
Conaskonk Point (Keyport Bar)	26
Sanitary survey	26
Keyport sewerage system	26
Matawan Creek	29
Bacteriological results	29
Conclusions	30
Lupatcong Creek	30
Methods used in "drinking" oysters in Lupatcong and Cheesequake Creeks	30
Sanitary survey of Lupatcong] Creek	30
Bacteriological results	31
Conclusions	32
Cheesequake Creek	32
Sanitary survey	32
Bacteriological results	33
Conclusions	33

Raritan Bay and vicinity—Continued. Page.
Other creeks on the south shore of Raritan Bay 34
Whale Creek 34
Conaskonk Creek 34
Flat Creek 35
South shore of Lower New York Bay 36
Shrewsbury and Navesink Rivers 37
Sanitary survey 37
Shrewsbury River 37
Navesink River 37
Bacteriological examinations 39
Conclusions 40
Sanitary conditions in Raritan Bay as a whole 40
Atlantic coast of New Jersey 42
From Cape May to Atlantic City 42
Cold Spring Harbor 42
Jarvis Sound 43
Taylor Sound 43
Vicinity of Five-Mile Beach 43
Conclusions 43
Richardson Bay 44
Jenkins Sound 44
Great Sound and vicinity 44
Ludlam Bay and vicinity 45
Vicinity of Peck Beach 45
Vicinity of Atlantic City 46
Lake Bay 48
Above Lake Bay 49
Absecon Bay 49
Great Bay 49
Little Egg Harbor 49
Tuckerton Creek 50
West Creek 51
Barnegat Bay 51
Summary and conclusions 52
Delaware Bay areas 53
Delaware River 53
Sanitary survey 53
Sources of pollution 53
Tides and currents 55
Dilution 56
Bacteriological and dissolved oxygen results 56
Delaware Bay 59
Summary and conclusions 59
Maurice River 60
General observations 60
Extent of oyster industry 60
Method of handling oysters 60
Nature of investigation 61
Sanitary survey of Maurice River watershed 62
I. River above Millville 62
Stream flow 62
Population 62
Sources of pollution 64

Maurice River—Continued.
Sanitary survey of Maurice River watershed—Continued. Page.
II. River below Millville.... 65
Sources of pollution.... 65
Tides and currents.... 67
Float tests.... 67
Results of examinations of oysters and water.... 70
Typhoid fever on the Maurice River watershed.... 72
Summary.... 73
Conclusion and recommendations.... 74
Cohansey River.... 75
Sanitary survey.... 75
Stream flow.... 77
Bacteriological studies.... 78
Summary.... 79
Conclusions.... 79
Infectious diseases and pollution of coastal waters.... 80
General summary and conclusions.... 82
Appendix I. Detailed results of examinations of samples of oysters and water and dissolved oxygen determinations.... 84
Appendix II. Record of typhoid fever cases on watershed of area investigated. 135
Appendix III. Report on Ocean City outbreak of typhoid fever by New Jersey Department of Health.... 143

LIST OF MAPS AND CHARTS.

MAPS.

No. 1. New York and Raritan Bays.... 10
2. Raritan River.... 15
3. Float tests in Arthur Kill and Raritan Bay.... 18
4. Keyport and Lupatcong Creek.... 27
5. Navesink and Shrewsbury Rivers.... 37
6. Delaware Bay.... 53
7. Delaware River, Trenton to Philadelphia.... 54
8. Delaware River, Philadelphia to Wilmington.... 54
9. Delaware River, Wilmington to Reedy Island.... 54
10. Maurice and Cohansey Rivers, drainage areas.... 63
11. Maurice River below Millville.... 69

CHARTS.

No. 1. Arthur Kill and Raritan Bay. Relation between *B. coli* count and dissolved oxygen.... 19
2. Delaware River. Relation between *B. coli* count and dissolved oxygen. 58
3. Diagram of float travel in Maurice River between Millville and Bivalve, N. J.... 68
4. Maurice River. Relation between *B. coli* count and dissolved oxygen. 72

LIST OF TABLES.

IN TEXT.

No. 1. Quantity of sewage and its treatment in cities along Raritan River... 14
2. Theoretical dilution of sewage of cities below Raritan.... 16
3. Sewerage entering Arthur Kill.... 17

Page.

4. Results of examinations of Keyport sewage and water over disposal plant outlet..... 28
5. Red Bank sewage..... 38
6. Important cities on tidal portion of Delaware River..... 54
7. Velocity of tidal currents in Delaware River..... 55
8. Mean number of *B. coli* per c. c. of water in Maurice River..... 71
9. Mean number of *B. coli* per c. c. of water at certain points in Cohansey River..... 78

IN APPENDIX I.

DETAILED RESULTS OF EXAMINATIONS OF SAMPLES OF OYSTERS AND WATER AND DISSOLVED OXYGEN DETERMINATIONS.

A. Raritan River, water samples..... 84
B. Arthur Kill and Raritan Bay, water samples, dissolved oxygen results... 85
C. Arthur Kill and Raritan Bay, analysis of Table B..... 87
D. New York side of Raritan Bay and lower New York Bay, oyster and water samples..... 88
E. Raritan Bay and lower New York Bay, water samples..... 91
F. Samples of mud, Raritan Bay..... 93
G. Raritan Bay, Conaskonk Point (Keyport Bar), oyster and water samples. 94
H. Matawan Creek, water samples..... 97
I. Lupatcong Creek, oyster and water samples..... 98
J. Lupatcong Creek, water samples..... 100
K. Cheesequake Creek, oyster and water samples..... 102
L. Navesink River, oyster and water samples..... 103
M. Shrewsbury oyster, and water samples..... 104
N. Atlantic coast of New Jersey..... 105
O. Little Egg Harbor, oyster and water samples..... 107
P. Barnegat Bay, oyster samples..... 108
Q. Delaware River, above Reedy Island..... 109
R. Delaware River and Delaware Bay below Reedy Island, water samples.. 116
S. Delaware Bay, Maurice River Cove, oyster and water samples..... 118
T. Delaware Bay, Delaware side, oyster and water samples..... 120
U. Analysis of Tables Q, R, S, and T..... 121
V. Maurice River, water samples..... 122
W. Maurice River, summary of results obtained from three series of samples from Millville to mouth of river..... 127
X. Samples of "floated" oysters, Bivalve and Maurice River..... 128
Y. Cohansey River, water samples and dissolved oxygen results..... 131
Z. Samples of "floated" oysters, Cohansey River..... 133

INVESTIGATION OF THE POLLUTION OF CERTAIN TIDAL WATERS OF NEW JERSEY, NEW YORK, AND DELAWARE, WITH SPECIAL REFERENCE TO BATHING BEACHES AND SHELLFISH-BEARING AREAS.

By HUGH S. CUMMING,
Surgeon, U. S. Public Health Service.

INTRODUCTION.

The first investigation of the tidal waters of Maryland and Virginia with special reference to the pollution of shellfish having been completed,[1] these studies were extended to include the coastal waters of New Jersey, New York, and Delaware.

Arrangements were made with the department of health of the State of New Jersey for cooperation, through which a party was to use the shallow-draft launch *Inspector*, of that organization, for studies along the Atlantic coast of New Jersey, while the Public Health Service laboratory steamer *W. D. Bratton* was to be utilized for an investigation of the Delaware River and Bay and their tributaries and the waters of Raritan Bay.

At the request of the Chief of the Bureau of Chemistry, a conference was held by representatives of the Bureau of Chemistry of the United States Department of Agriculture, the New Jersey department of health, and the Public Health Service, during which it was stated that the authorities of the city of New York had forbidden the sale of oysters taken from the New Jersey side of Raritan Bay.

In view of the discrepancy between results obtained by the State board of New Jersey, the Bureau of Chemistry, and the New York authorities, and in view of the fact that oysters from the condemned areas were sold during the summer season, it was agreed that the Public Health Service should begin the investigation of the shellfish areas in Raritan Bay as soon as practicable. Accordingly, the laboratory steamer *Bratton* proceeded to Keyport, N. J., with a party which consisted of Surg. H. S. Cumming, Asst. Surg. C. E. Waller, Sanitary Engineer C. A. Haskins, and Bacteriologist H. V. Stewart.

The investigation of those waters was conducted from June 21 to August 20, 1915, when the vessel was moved to the Delaware River. The party returned to the vicinity of New York on November 12 and continued work until December 5, in order that the conditions prevailing during the period of change from moderate to low tempera-

[1] See Public Health Bulletin No. 74.

tures could be observed. This is the most important period of the shellfish business, from both the sanitary and economic points of view.

On August 25 the Delaware River studies were commenced, which alternated with those on Delaware Bay and its tributaries over a period of several months, the investigation being finished in December. At about the same time the investigation of waters on the Atlantic coast of New Jersey was begun, and conducted jointly by representatives from the State board of health and a party from this service.

In June, 1916, a reexamination of the water and shellfish of that portion of Raritan Bay and tributary waters on the New Jersey side was made in cooperation with representatives of the Bureau of Chemistry, United States Department of Agriculture, the State department of health of New Jersey, and the city of New York.

SCOPE AND METHODS OF INVESTIGATION.

Form of studies.—The studies took the following form:

1. A sanitary survey of the drainage area of the waters studied, with their tributaries, the survey including—
   - A. Character and amounts of sewage and wastes discharged into the waters.
   - B. Population on the watershed.
   - C. A study of the direction and velocity of currents and tides with reference to their effect on the pollution of certain areas and on the time factor in purification, etc., including the conducting of float experiments.
   - D. A study in detail of sanitary conditions in the vicinity of the shellfish beds and of the water in which they were situated.
2. The bacteriological examination of samples of oysters and water from the areas investigated, including oysters freshened or floated after being taken from the beds, and of sewage effluents from disposal plants discharging into the areas studied.
3. Chemical examinations for the determination of dissolved oxygen, etc.
4. A study of the amount and seasonal prevalence of typhoid fever in the communities adjacent to the waters investigated, with special reference to ascertaining what proportion, if any, of such cases were due to bathing in polluted water or to the ingestion of infected shellfish from such waters.

Technique of collection and examination of samples.—The method of collecting samples and the technique of examination were those which have been used in our previous investigations and described in Hygienic Laboratory Bulletin No. 104 and Public Health Bulletin No. 74, with the following exceptions:

Analyses of results obtained in previous examinations show that no considerable information as to infectious pollution can be obtained by the total colony count on agar at 20° C. from a composite sample of shell liquor. This opinion is held also by all the members of the committee of the American Public Health Association on standards for the examination of shellfish and by all other bacteriologists consulted; therefore a count upon agar at 37° was substituted.

In addition to the determination of the *B. coli* content and the total count, oyster and water samples were examined for streptococcus forms, from which, however, no information of definite value was obtained.

Determinations of dissolved oxygen were made according to the Winckler method as modified by Elvove.[1]

Floats.—The floats used were those constructed and used by the United States Coast and Geodetic Survey in connection with the investigation of the Potomac River by the Public Health Service, and were similar to those used by the Metropolitan Sewerage Commission in the investigation of the pollution in New York Harbor.

[1] Hyg. Lab. Bull. 96.

RARITAN BAY AND VICINITY [1]

GENERAL VIEW OF AREA.

DESCRIPTION.

The area covered in this investigation includes all of lower N York Bay west of a line from Fort Wadsworth (at the west side the Narrows) southeastward to Sandy Hook, with Staten Island the north and west, and the north shore of New Jersey to the so and west, together with the waters tributary to this area.

The area is triangular in shape, with the base east. Ten miles this base is open to the sea. The waters entering this side of triangle come from the Atlantic Ocean and through the Narr from Upper New York Bay.

The southeastern portion of this area (lying west of and parti embraced by Sandy Hook, and extending as far as Point Comf is called Sandy Hook Bay. Into its southern portion discharge Shrewsbury and Navesink Rivers through a common narrow entran

The apex of the triangular Raritan Bay area is about 15 miles w of the eastern entrance, and into it discharge the Raritan Riv and Arthur Kill, which are the only tributaries of large size. large streams on Staten Island discharge into the area, but there two small bays, one of which, Great Kills, is a body of water wi an entrance ½ mile wide, opening southwestward. It lies about miles southwest of the Narrows, is about 1½ miles long, is shallo and receives a small creek at its head.

Princess Bay is an identation in the Staten Island shore about 1 miles below the Narrows. A small stream called Lemon Creek di charges into Princess Bay.

There are several small tributaries of sanitary importance whi discharge into Raritan Bay from the New Jersey (or south) sid including Cheesequake, Matawan and Lupatcong Creeks, and t Shrewsbury and Navesink Rivers.

The bay is of moderate depth throughout, the bottom sloping grad ally from either shore to depths varying from 8 to 15 feet over bro areas of sand flats for distances of 1 to 2 miles on either side of t channel. However, the channel, from the junction of Raritan Riv and Arthur Kill, is narrow, deep, and hugs the Staten Island shore f 3¼ miles to Seguine Point, which marks the eastern end of Princ Bay.

[1] See Map No. 1. [2] See map No. 2.

On the south side of this western section of the channel the shoal reaches from the New Jersey shore northward to end in Round Shoal, the edge of which is only about 400 yards from Seguine Point. From this point a channel dredged to 19 feet depth for about 2,700 yards leads southeastward toward the middle of the bay. From about 1¼ miles south of Seguine Point there is a constantly widening area of water, from 20 to 30 feet in depth, toward the eastern limit of the area, where there are three deep passages connecting Raritan Bay with the eastern part of lower New York Bay and the Atlantic Ocean.

The configuration of the bottom on this eastern side of the area is of great importance in determining the direction and extent of currents to and from the Upper Bay or the ocean, and consequently the amount of pollution which may reach the Raritan Bay shellfish beds from New York Harbor on the one hand, and the dilution by ocean waters on the other.

Reaching from Fort Wadsworth southward for about 3 miles to a point below Swinburne Island, is a narrow bar called West Bank, over which the water has a depth of from 1½ to 9 to 10 feet. Below Swinburne Island the water gradually deepens to a depth of 20 feet at West Bank Light.

Romer Shoal begins about 900 yards southeast of West Bank Light and extends southeastward for 3¾ miles, with depths varying from 3 to 15 feet.

South of Romer Shoal, and separated from it by the Swash Channel, are other shoals, including Flynn Knoll. Sandy Hook Point lies 1,200 yards south of Flynn Knoll and is separated from it by the main channel. Ambrose Channel is east of these bars and runs southeast from the Narrows to the ocean.

SHELLFISH AREAS.

New York side.—There are extensive oyster beds on both sides of the channel of Raritan Bay, the beds on the New York side covering the larger area and extending from near West Bank and around Old Orchard Light all along the Staten Island flats nearly to the Great Beds Light at the junction of the channels from Raritan River and Arthur Kill.

For convenience they may be described in three groups, beginning at the west: (*a*) The Princess Bay area, which lies on Round Shoal, across the channel from Princess Bay; (*b*) the Great Kills area, which extends from Seguine Point eastward and opposite Great Kills; (*c*) the Old Orchard area, which lies around that light and extends northeasterly toward West Bank and Hoffman and Swinburne Islands.

In addition, oysters grow in Great Kills and all along the foreshore of Staten Island, as well as in Arthur Kill. Approximately 20,000

acres or 30 square miles of beds are included in the oyster bearing area within the jurisdiction of the State of New York.

According to information courteously furnished by Mr. Emmett B. Hawkins, supervisor of the Bureau of Marine Fisheries, Conservation Commission of the State of New York, the cultivated oyster beds in Raritan Bay equal 8,800 acres. The value of the industry was not known:[1]

New Jersey side.—On the New Jersey or the southern side of the bay the only area of importance is that of Conaskonk Point, or Keyport Bar.

The region is of great commercial importance because of the immediate proximity of New York and other large cities, which consume great quantities of shellfish throughout the year.

The suitable hard bottom, the influx with each tide of enormous quantities of seawater, and the presence of abundant food swept down by streams combine to make the area of great value in growing oysters.

It is understood that most of the seed oysters are brought from Chesapeake Bay, Long Island Sound, and other outside districts, though a quantity are also grown in the beds around and westward of Princess Bay.

The oysters from the New York beds are used chiefly for winter trade, both shell and shucked; and large quantities are carried to Keyport, where, after immersion for one or more tides in Lupatcong or Cheesequake creeks, they are shucked or shipped as shellstock.

The industry of Keyport is very largely a summer one; oysters from Chesapeake Bay are planted during the early spring months on Keyport Bar or Conaskonk Point, taken up during the summer, allowed to "drink" in Lupatcong Creek, and sold as shellstock. Owing to the high *B. coli* score in oysters taken from Lupatcong Creek and Keyport Bar found by representatives of the Bureau of Chemistry of the Department of Agriculture and the board of health of New York City, the Interstate shipment of oysters from these sources or their entry into the city of New York was forbidden. In view of the trade being a summer one, it was considered advisable to investigate conditions during that season.

In addition to the oyster beds described, the flats and foreshores have many extensive hard clam or quahog (*Venus mercenaria*) and soft clam (*Mya arenaria*) producing areas. The flats of Sandy Hook Bay are especially prolific in clams and the industry is chiefly a summer trade, though the foreshores are fished for clams throughout the year. This industry is unorganized and is carried on by individuals.

In general, the industry on the New York side is to a great extent

[1] Letter Nov. 8, 1915.

controlled by large corporations which have other holdings elsewhere, while the Conaskonk Point or Keyport Bar beds are controlled by small dealers.

SCOPE OF STUDIES.

Following out the general scheme for the investigation, a survey of Raritan Bay and vicinity was conducted with the following objects in view: First, to estimate the quantity and character of the sewage and wastes from human sources discharged into the streams on the watershed of the bay; second, to find the effect of such sewage and wastes on the waters of the streams and the bay; and, third, to establish the presence or absence of the danger of infection of the shellfish beds or "drinking" grounds located within the bay or its tributaries. Studies were therefore made of the number of persons residing on the watershed, rural and urban, the sewer systems, and disposal of sewage from the communities, the courses and velocities of currents and tides through the bay, the shellfish, and the water in which the beds are located.

The sources of pollution of Raritan Bay may be enumerated as follows: (1) Communities situated on the streams which drain into the bay. (2) Communities situated along its shores. (3) Upper New York Bay (through The Narrows). (4) Shipping on the bay. This last is of such small amount in proportion to the large volume of water in the bay that it need not be considered.

Studies were made of the Raritan River, Arthur Kill, the Shrewsbury and Navesink Rivers, and currents from Upper New York Bay, which is polluted by sewage from the city of New York and several municipalities in New Jersey; and detailed inspections were made of the shores of the bay and the creeks used for "drinking" oysters.

In view of the enormous amount of work done and the data secured by the Metropolitan Sewerage Commission from 1906 to 1914 and made available through its valuable reports, no study was attempted of upper New York Bay itself or the communities contributing pollution to it. Frequent reference to the reports will be found throughout this bulletin.

RARITAN RIVER.

SANITARY SURVEY.[1]

With the exception of the Delaware, the Raritan is the largest river in New Jersey and is quite important, aside from its possibilities of power development, in that it is used extensively as a source of water supply and a means of sewage disposal by communities in its neighborhood. The river rises in the hills of Morris County and flows

[1] See Appendix II, page 135, for record of typhoid fever cases in New Brunswick, Perth Amboy, South Amboy, Borough of South River, etc.

in a generally southeast direction to Raritan Bay.[1] It drains 1,105 square miles of territory. From Fieldville dam to its mouth at Perth Amboy, a distance of about 17 miles, it is tidal and navigable. There are about 170,000 inhabitants on the drainage area, of whom 122,000 live in cities of 1,000 population or over. There are 16 cities, with a combined population of about 90,000, having sewer systems, but only 67,000 of the inhabitants of these cities are estimated to be tributary to the sewers. There are several factories on the watershed, employing about 6,000 persons. Some of these factories produce wastes of a more or less objectionable character. About one-half of the total watershed is tributary to lakes or streams furnishing domestic water supply; consequently the sewage from many of the towns on the upper drainage area is satisfactorily treated. Along the lower part of the watershed, however, sewage is discharged directly to the watercourses with no preliminary treatment. The following table, No. 1,[2] shows the places having sewer systems, population by the 1910 census, the estimated sewage flow, and whether or not the sewage is treated:

TABLE No. 1.—*Quantity of sewage and its treatment in cities along Raritan River.*

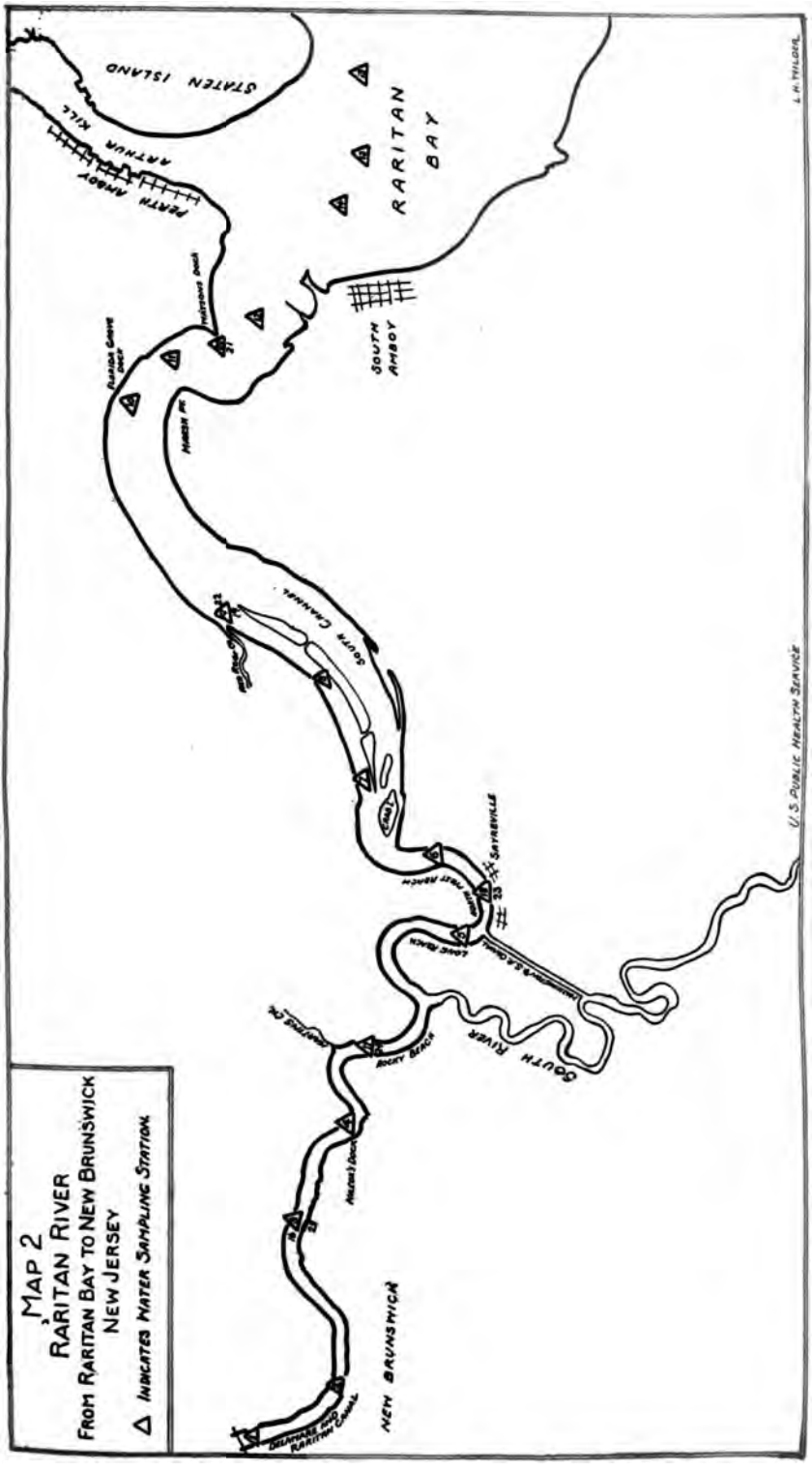
Place.	Population, 1910.	Name of stream.	Quantity of sewage.	Treatment.
			Gallons.	
Ralston	250	North Branch Raritan River	3,000	
Far Hills	350	do	15,000	Yes.
Glen Gardner	800	South Branch	50,000	Yes.
Flemington	2,800	do	200,000	Yes.
Hightstown	2,100	Millstone River	130,000	Yes.
Princeton	5,200	do	400,000	Yes.
Hopewell	1,070	do	15,000	Yes.
Skillman	400	do	50,000	Yes.
Jamesburg	1,600	South River	60,000	Yes.
Helmetta	660	do	15,000	Yes.
South River	5,000	do	150,000	No.
Plainfield	21,000	Green Brook	1,800,000	Yes.
South Plainfield	1,050	do	800	Yes.
Lincoln	300	do	30,000	No.
Milltown	1,500	Lawrence Brook	150,000	No.
Raritan	3,800	Raritan River	300,000	No.
Somerville	5,500	do	450,000	No.
Bound Brook	4,000	do	300,000	No.
Highland Park	1,600	do	115,000	No.
New Brunswick	23,000	do	2,300,000	No.
Perth Amboy [1]	10,000	do	1,000,000	No.
Total	91,980		7,555,800	

[1] About one-third of Perth Amboy sewage discharged into Raritan River.

About 7,500,000 gallons of sewage per day is discharged into the river or its tributaries, of which 4,500,000 gallons, more than one-half, is untreated. Practically all of the untreated sewage enters the river below Raritan and within 30 miles of its mouth.

[1] See map No. 2.

[2] State Board of Health of New Jersey, Annual Report for 1914.


MAP 2
RARITAN RIVER
FROM RARITAN BAY TO NEW BRUNSWICK
NEW JERSEY
△ INDICATES WATER SAMPLING STATION
STATEN ISLAND
RARITAN BAY
SOUTH AMBOY
SOUTH RIVER
NEW BRUNSWICK
U.S. PUBLIC HEALTH SERVICE

In Table No. 2 [1] are shown the places discharging raw sewage below Raritan; also the average daily stream flow in gallons and the theoretical dilution of sewage by water in the river.

TABLE No. 2.—*Theoretical dilution of sewage of cities below Raritan.*

Place.	Sewage (gallons daily).	Total sewage flow (gallons daily).	Stream flow (gallons daily).	Theoretical dilution.
Raritan	300,000	.....	65,880,000	210
Somerville	450,000	750,000	67,380,000	90
Bound Brook	300,000	1,050,000	129,852,000	120
Highland Park and New Brunswick	2,415,000	3,465,000	134,982,000	300
South River	225,000	3,690,000	.....	.....
Perth Amboy (part of)	1,000,000	4,690,000	187,000,000	1,450
South Amboy	500,000	5,190,000	[1] 6,640,000	.....

[1] Tidal flow.

With this enormous dilution no evidences of sewage are visible in the river at New Brunswick and consequently none at Perth Amboy.

BACTERIOLOGICAL RESULTS.

Three series of samples of water for bacteriological examination were taken along the river in September, November, and December, from New Brunswick to Perth Amboy, the results of which are shown in Table A, page 84.

ARTHUR KILL.[2]

SANITARY SURVEY.

Arthur Kill is a narrow, winding, tidal stream, about 13 miles long, which separates the western side of Staten Island from the mainland of New Jersey. It connects Newark Bay and Kill Van Kull with Raritan Bay and is navigable throughout for ocean-going vessels. It is rapidly becoming one of the important shipping ports of New York Harbor. Except near its two ends the shores are rather sparsely populated, but there are many factories and an increasing urban population, particularly on the New Jersey side. It has a drainage area of only about 167 square miles (or 353 square miles if 17 per cent of Newark Bay and Kill Van Kull tributary to Arthur Kill are included). Its average flow of water on the ebb tide is about 330,000,000 cubic feet on each tide, or 4,936,800,000 gallons per day.[3] This includes the drainage from the Elizabeth and Rahway Rivers and Woodbridge Creek. The bulk of water, 297,000,000 cubic feet per tide or about 4,443,120,000 gallons per day, is tidal, and about 493,680,000 gallons per day represents the fresh-water flow. The

[1] State Board of Health of New Jersey, annual report for 1914.

[2] See Map No. 1.

[3] Report Metropolitan Sewage Commission 1912, p. 22. Ibid, Report 1914, Table CVI.

net ebb is 33,000,000 cubic feet. It is estimated that 17 per cent of the total discharge on ebb tide flows from Newark Bay, which is heavily polluted. Table No. 7 shows the places from which sewage is discharged into Arthur Kill, the population of the places, and their estimated sewage flow:

TABLE NO. 3.—*Sewage entering Arthur Kill.*

City.	Population.	Estimated sewage flow (gallons daily).
Perth Amboy (part of)	32,121	2,350,000
Woodbridge Township	5,500	500,000
Roosevelt (including Chrome, Carteret, and Port Reading)	5,786	[1] 683,000
Rahway (discharges to Rahway River)	9,337	1,000,000
Cranford and Garwood (discharge to Rahway River)	4,759	[2] 1,500,000
Linden	602	62,000
Joint trunk sewer [3]	43,229	11,100,400
Elizabeth [4]	73,409	9,000,000
Tottenville, Staten Island	.....	[5] 1,154,700
Total	173,743	27,350,100

[1] Includes 350,000 gallons from Maurer.
[2] Includes some factory wastes.
[3] Joint trunk sewer serves following places: South Orange, West Orange, Irvington, Millburn, Summit, Roselle Park, Newark (part of), 3,000,000 gallons daily; and Elizabeth (part of).
[4] Includes all of Elizabeth sewage.
[5] From gaugings by bureau of sewer plan, board of estimate and apportionment, city of New York.

Arthur Kill receives the wastes from about 50 factories in addition to those shown in the table, among them several oil and asphalt refineries and chemical works. These plants discharge wastes into Kill sufficient to cause a heavy "sleek" on the surface of the water most of the time. About 17,000 persons are employed in the factories on the shore of the Kill and Woodbridge Creek and are served either with sewers direct to the water or by overhanging privies. About 75 per cent of these persons live in the towns included in the table, but the remaining 25 per cent live in communities which are not sewered. Practically none of the sewage reaching Arthur Kill is treated. If all of the water on the ebb tide is considered available for dilution, neglecting that water below the tidal prism, there is a dilution of about 180 times; but this figure is too high, for the reason that sewage in Arthur Kill is carried backward and forward for several days before it leaves the Kill, as shown by various float tests made by the Metropolitan Sewage Commission of New York and described in the report of that body for 1914:

Float 61 December 16–18 showed:
Total distance traveled, flood, 16.97 miles in 21.5 hours.
Average velocity, flood, 0.79 mile per hour.
Maximum velocity, flood, 1.80 miles per hour.
Total distance traveled, ebb, 11.80 miles in 15 hours.
Average velocity, ebb, 0.79 mile per hour.
Maximum velocity, ebb, 2.33 miles per hour.

Also, a large amount of the water flowing into the Kill on floo is from Raritan Bay, which can not always be considered polluted water, and a small part (0.17) is from Newark Bay, as has been mentioned, is seriously polluted.

The resultant flow of Arthur Kill is toward Raritan Bay.

BACTERIOLOGICAL AND DISSOLVED OXYGEN RESULTS.[1]

Various dissolved oxygen determinations and bacteriol examinations made of water from Arthur Kill during this stud shown in Table B (p. 85), an analysis of which is shown in T (p. 87).

A record of cases of typhoid fever in the territory adjacent t area will be found in Appendix II (p. 135).

CONCLUSIONS.

These results indicate that a water with low oxygen cont summer and with *B. coli* present in 0.1 c. c. may be expected narily from Arthur Kill at Great Beds Light, near which th from the Kill and that from Raritan River, with approximate same *B. coli* content, unite on ebb tide to flow into Raritan This point is about 3 miles above the upper limits of the shellfish from which oysters are taken to be floated and then sold as foo

The practice of bathing in this body of water, as was obser Perth Amboy, Elizabethport, and other points along its sho obviously dangerous and should be condemned.

WESTERN PORTION OF RARITAN BAY.

SANITARY SURVEY.

An examination of the map showing the topography of the b of this area [2] will suggest the probable direction of ebb currents the above streams. One channel, which has been dredged to 1 depth, leads northeastward, hugging the Staten Island shore Red Bank to Princess Bay and Seguine Point; north of Round it turns east and southerly through another 19-foot channel t deep water. A wider, ill-defined channel of 11 to 15 feet depth eastward from Great Beds, past the south end of Round Shoal, deep channel between Keyport Bar and Round Shoal. The appears the most direct and probable course for both ebb and currents from and to Arthur Kill and Raritan River.

Float tests.—Six float tests were made by the Public Health S party to determine the extent and the direction of the ebb cur

[1] See Chart 1. [2] Map No. 3.

A large Coast Survey type float (Float 6) was started at the beginning of ebb tide just below Great Beds Light, at the junction of the channel from Raritan River and Arthur Kill. The wind was light and negligible for this type of float and the stream flow about average.

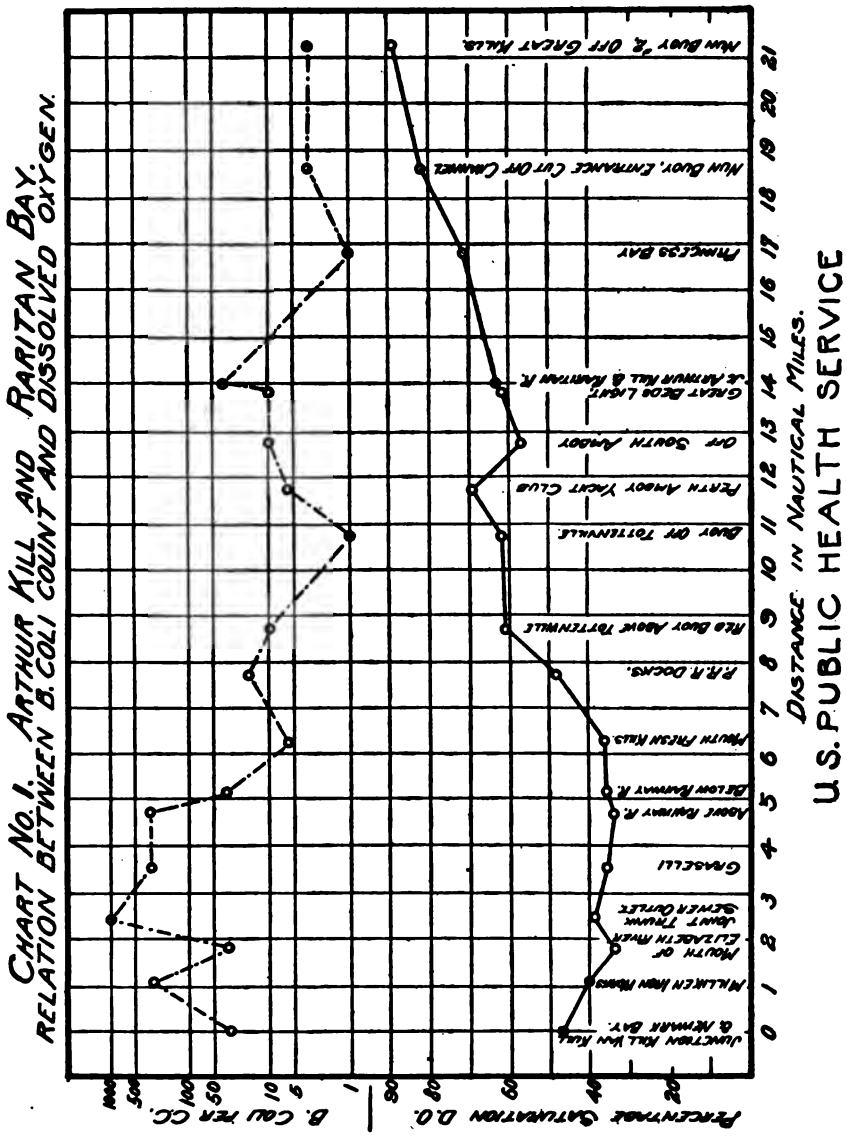


CHART No. 1. ARTHUR KILL AND RARITAN BAY.
RELATION BETWEEN B. COLI COUNT AND DISSOLVED OXYGEN.
U.S. PUBLIC HEALTH SERVICE
DISTANCE IN NAUTICAL MILES.
PERCENTAGE SATURATION D.O.
B. COLI PER CC.
JUNCTION KILL VAN KULL & ARTHUR KILL
NEWARK BAY
MOUTH OF ELIZABETH RIVER
ABOUT RAILWAY R.
BELOW RAILWAY R.
NORTH PRISM KILLS
P.R.R. DOCKS.
RED BUOY ABOVE TOTTENVILLE
BUOY OFF TOTTENVILLE
PERTH AMBOY YACHT CLUB
OFF SOUTH AMBOY
GREAT BEDS LIGHT
AT ARTHUR KILL & RARITAN R.
PRINCESS BAY
BUOY, ENTRANCE CUT OFF CHANNEL
BUOY "R" OFF GREAT KILLS

The float started northeastward through the cut channel toward Princess Bay, followed the channel north of Round shoal, and then drifted in a southeasterly and southern course toward the middle of Raritan Bay, near black can buoy C. Flood tide was beginning

when the float was picked up after it had traveled 4 nautical miles in about six hours.

Floats 1 and 2 were set out in Arthur Kill opposite Perth Amboy and followed the channel down to the central channel and were taken up south of Round Shoal about a mile northeast of the boundary beacon, having traveled about 3½ nautical miles in five and one-half hours.

Floats 3 and 4 were set out together in Arthur Kill channel near the starting point of 1 and 2, and were carried down to the junction point with Raritan River, where they traveled northeastward in the dredged channel to the western edge of Round Shoal about opposite Red Bank, when they were taken up after having traveled approximately 2¾ nautical miles in about five and three-fourths hours.

Float 5 was set out on ebb tide above the mouth of Arthur Kill, near spar buoy 1 Q, and traveled to the west edge of Round Shoal, near the point where floats 3 and 4 were taken up, when the tide turned and it was carried up Arthur Kill to a point above Tottenville and Perth Amboy, just below the entrance to Mill Creek, having traveled in one flood tide about 4 nautical miles.

From the above studies it appears evident that such pollution as is present in the Great Beds area from Arthur Kill and Raritan River will be carried to the channels north and south of Round Shoal for at least one or two hours of each ebb tide, and longer during periods of heavy stream flow.

Factors in pollution of area.—At Seguine Point a dental instrument factory employing 600 persons discharges raw sewage into the Princess Bay area. Near Princess Bay Light the Mission of the Immaculate Virgin, with a total population of about 1,800, discharges about 200,000 gallons of raw sewage a day in the immediate vicinity of shellfish beds. While a study of the bacteriological results [1] does not show any evidence of heavy pollution in the neighborhood of these sewer outlets, the danger of discharging fresh sewage directly on oyster beds, even with a high dilution of water, must be realized. Both of the outfalls are across the channel from Round Shoal.

There are large areas of oyster grounds on the shoal, most of which are used for "seed" purposes, though it is stated that some oysters therefrom are used for food.

BACTERIOLOGICAL RESULTS.

Twenty samples of oysters and 42 samples of water were taken from this area in July and August and examined, with the following results: [2]

[1] See Table D (p. 88.)

[2] For details see Tables D and E (pp. 88 and 91.)

Only one sample of oysters scored as high as 23, while four gave scores of 14, and the others scored not higher than 5.

Of the samples of water taken with the oysters, *B. coli* was absent in 2, or 10 per cent in 10 c. c.; present in 18, or 90 per cent, in 10 c. c.; present in 11, or 55 per cent in 1 c. c.; and present in only 1, or 5 per cent in 0.1 c. c.

Of the remaining 22 samples of water taken in this area, 22, or 100 per cent, showed *B. coli* present in 10 c. c.; 19, or 86.3 per cent, showed *B. coli* present in 1 c. c.; and 8, or 36.3 per cent, showed *B. coli* present in 0.1 c. c. Seven of the eight samples showing *B. coli* present in 0.1 c. c. came from the upper end of the area, over a mile from the oyster beds.

CONCLUSIONS.

The presence of the two sewers and other local sources of pollution make it dangerous to use oysters from the foreshore north of the channel, but the bacteriological results obtained from the samples of oysters and water on Round Shoal indicate little pollution.

Bathing along the shores of this area is considered safe, except in that portion of the bay above Great Beds Light and in the neighborhood of local sources of pollution, such as exist at Seguine Point and opposite the Mission of the Immaculate Virgin.

EASTERN PORTION OF RARITAN BAY AND LOWER NEW YORK BAY.

SANITARY SURVEY.

The greatest possible sources of pollution of this area, in addition to those which have been already mentioned, are the cities the sewage from which is discharged into New York Harbor and thence through the Narrows into the Lower Bay.

The amount of sewage discharged into the harbor daily was estimated in 1910 as 604,000,000 gallons, and it is estimated that in 1917 the amount discharged will approximate 700,000,000 gallons daily.[1] In a short time there will be added to this quantity about 630,000,000 gallons daily from the Passaic Valley sewer.

Tides and currents.—The sources and approximate amounts of sewage which enter the region being known, a study of tides and currents was made to determine whether excessive pollution of the shellfish beds of this area might be expected from such sources.

According to the United States Coast and Geodetic Survey and the Metropolitan Sewage Commission,[2] the mean resultant or net flow seaward—i. e., excess of ebb over flood tide at the Narrows—is about 1,282,300,000 cubic feet per cycle of 12 hours, the resultant varying

[1] Karl Imhoff, p. 317, Met. Sew. Com. Rep., 1914.

[2] Pp. 179 et al., Report, 1910.

from 41 per cent greater than the mean to 46 per cent less than the mean. There is an excess of ebb flow of from 10 to 15 per cent, even in seasons of low river flow.[1].

As a result of many float tests, the commission concluded, regarding movements in the Upper Bay:

1. Floating matter starting in the channel near Robbins Reef may, within one tidal period, reach the shores of the Hudson as far as Sixtieth Street, Manhattan, or of Staten Island at any point in Kill Van Kull, Upper Bay, or Lower Bay, as far as South Beach. It may strand on the Brooklyn shore at any point south of Red Hook with a westerly wind, but a strong ebb current may carry it as far out as Romer Shoal. * * * (Robbins Reef is the point of discharge for the Passaic Valley sewer.)

4. Ordinary velocities encountered in the Upper Bay on flood are: Mean, 1.2 miles per hour; maximum, 1.8 miles per hour.

5. Ordinary velocities encountered in the Upper Bay on ebb tide are: Mean, 1.6 per hour; maximum, 2.5 to 3.1 miles per hour.[2]

The velocities of currents at the Narrows are: Mean ebb, 2.0; flood, 1.6 miles per hour; maximum ebb, 2.8; flood, 2.3; minimum ebb, 1.1; flood, 0.9.

The distance from the Narrows to the Battery at the lower end of Manhattan is about 4 miles, so that a large though undetermined amount of sewage is carried on one tide from the outfalls of Manhattan, Staten Island, and Brooklyn into the Lower Bay. This fact was established by various float tests.

The condition of the water at the Narrows, as determined by the commission, is shown in the following abstract:

Dissolved oxygen in July, 1909, 71 to 91 per cent of saturation on ebb tide and 85 to 100 per cent of saturation on flood tide. The table for 1911 shows 76 to 79 per cent saturation for all tides. Bacterial counts on gelatine at 20° averaged for all tides and depths 4,500 colonies per cubic centimeter; average, surface, 8,300; bottom, 1,900. Average number of colonies on flood tide, 2,500; ebb tide, 6,700. (There appears to have been no determination of the *B. coli* content.) Samples of mud taken from the bottom constantly showed evidence of gross pollution, and this area of bottom pollution appears to reach south almost to Sandy Hook.

It is estimated that even at the Narrows the velocity is slackened for 50 per cent of each total tidal cycle sufficiently to permit deposits of sewage solids (Table V, Report 1910).

In the lower bay "in the Main and Swash Channels the flood current starts in on the north side of the channel 15 minutes later than on the south side, and the ebb starts out on the south side of the channel 15 minutes earlier than on the north side. . . . The currents at half ebb in the Swash Channel set eastward strongly."[3]

A study of the surface appearances only suggests that a very large part of the ebb tide flow from the Narrows would spread somewhat and cause a heavy pollution on at least that part of the Staten Island flats which lie eastward of Old Orchard Light and Great Kills; but

[1] Coast Pilot, U. S. C. & G. S., and Met. Sew. Com. Report, 1910.
[2] Report, 1910, pp. 204–5.
[3] P. 32, Atlantic Coast Pilot V.

the West Bank already described acts as a jetty or breakwater to protect the area.

The mean prevailing winds in the district are from northwest throughout the year except during June and July, when they are from the southwest.

As a result of numerous float observations the Metropolitan Sewage Commission concluded:

> The most striking characteristic of the records, considered as a whole, is the fact that the currents in the middle of New York Bay run parallel to the Ambrose Channel and follows its turns at the upper end.[1]

That all of the water from the Narrows does not follow this channel, however, is shown by the following:

> A tendency to continue down the old Main Ship Channel instead of turning out to sea through Ambrose Channel was marked in some floats leaving the Narrows. These floats were all halted near West Bank or Romer Shoal light houses.
>
> Other floats dropped at these points on the first of the flood, either turned north toward the Narrows or went into Raritan Bay. In the former case they were likely to turn near Swinburne or Hoffman Island and go out by Ambrose Channel or return to West Bank Light. In the latter case, a float would go into Raritan Bay only to Old Orchard Light or a little further and return on ebb current.
>
> One float released off Sandy Hook at slack water went almost due west for about 4 miles on the flood current and then returned to a point near the starting place.[2]

In the report for 1910, p. 210, experiments were taken to indicate:

> 1. Floating matter is not likely to drift back into the upper bay if it has passed 6 or 8 miles below the Narrows.
>
> 2. Under certain conditions it may travel westerly to Raritan Bay to a point south of Great Kills, but ordinarily it will pass out to sea in a southeasterly direction.

The commission states [3] that the extreme points reached in a single tide by floats set adrift near Robbins Reef, the site of the Passaic Valley sewer outlet, were:

> In the lower bay 2¾ miles southeast of West Bank, 11.50 miles in six hours; and 2 miles southwest of West Bank, 11.25 miles in 6 hours 30 minutes.

The report of the commission for 1910, pages 159 et seq., contains charts illustrating the set of surface currents during the tidal cycle. During the first and second lunar hours there is a set from the Narrows down the Staten Island shore; during the third hour this ceases. During the fourth lunar hour, while the ebb continues to bring down polluted harbor water from the Narrows, there is a set from the channel into Raritan Bay.

Floats 88, 90, and U (Metropolitan Sewerage Commission), in Map. No. 3, page. 18, illustrate the occasional course of the currents.

It is evident from the foregoing that some surface water from the Upper Bay does reach the Staten Island Flats around Old Orchard Light and to the north and east of this point.

---

[1] P. 508, Rep. 1914. [2] Ibid., Rep., 1914, p. 508. [3] P. 200, Rep., 1910.

The commission [1] refers to the fact that "sewage discharged in salt or brackish water tends to rise and float off at the surface." This is confirmed by the bacterial results obtained by the commission and by others, as well as by our own observations.

The tide over the Staten Island Flats off Great Kills opposite Elm Tree Beacon, up to Seguine Point, is weak, and the direction irregular.

A line of tide rip with floatage was observed frequently by the writer, reaching southeastward from about this area and marking the confluence of the ebb drift from Arthur Kill and Raritan River with that from the Narrows and the lower New York Bay.

Staten Island Flats.—The Staten Island Flats, bounded by a line extending from Seguine Point northeasterly to Hoffman and Swinburne Islands, thence in a southwesterly direction to Old Orchard Light, and thence to Seguine Point, include a large and important area of cultivated oyster beds.

To complete the survey of the shellfish beds lying on the north side of the bay, a close sanitary inspection of the south and east shore of Staten Island was made from South Beach to Tottenville. The sewage from the resorts at the lower end of the bay (South Beach, Middle Beach, etc.) is taken care of by cesspools which are regularly cleaned by scavengers. No sewer which discharges into the bay was found at any of the beaches. At Sea View Avenue, near the extreme northeastern limits of the shellfish beds, is a combined sewer of the Richmond Borough of the city of New York system, discharging directly into the bay with no treatment provided for the sewage.

BACTERIOLOGICAL RESULTS.[2]

Of 55 samples of oysters taken from this whole area during the first inspection, in July, August, and September,

6, or 10.9 per cent, gave scores of 140 or higher; 11, or 20 per cent, gave scores of 50 or higher; 17, or 30.9 per cent, gave scores of 41 or higher; and 30, or 54.5 per cent, gave scores of 32 or higher;

while of the same number of samples of water taken from over the oyster beds,

49, or 89 per cent, showed *B. coli* present in 10 c. c.; 34, or 61.8 per cent, showed *B. coli* present in 1 c. c.; and 17, or 30.9 per cent, showed *B. coli* present in 0.1 c. c.

Of the 36 samples of oysters taken during this period from that portion of the area eastward of a line drawn south from the west side of the entrance to Great Kills to Point Comfort on the New Jersey shore,

4, or 11.1 per cent, gave scores of 230; 5, or 13.8 per cent, gave scores of 140 or higher; 8, or 22.2 per cent, gave scores of 50 or higher; 14, or 38.8 per cent, gave scores of 41 or higher; 23, or 63.9 per cent, gave scores of 32 or higher;

[1] Rep., 910 (p. 183).

[2] For details, see Tables 4, D and E (pp. 88 and 91).

and only 13, or 36.1 per cent, scored less than 32; while of the samples of water taken therewith,

34, or 94.5 per cent, showed *B. coli* present in 10 c. c.; 28, or 77.9 per cent, showed *B. coli* present in 1 c. c.; and 15, or 41.6 per cent, showed *B. coli* present in 0.1 c. c.

Of 19 samples of oysters taken from the beds west of the above line, north of the main channel,

1, or 5.2 per cent, gave a score of 140; 3, or 15.6 per cent, gave a score of 50 or higher; and 7, or 36.8 per cent, gave a score of 32 or higher;

while of the samples of water taken therewith,

15, or 78.9 per cent, showed *B. coli* present in 10 c. c.; 8, or 42.1 per cent, showed *B. coli* present in 1 c. c.; and 2, or 10.4 per cent, showed *B. coli* present in 0.1 c. c.

The sample which scored 140 and one of the samples which scored 50 were taken on different occasions from the same place, about 700 or 800 yards off the Staten Island shore and about 1¼ miles westward of the entrance to Great Kills. Two samples taken nearer the entrance to Great Kills scored 41 each, with *B. coli* present in 1 c. c. quantities of water.

In addition to the samples of water taken with the oysters from this area during the first inspection there were 22 other samples taken. Of the 9 samples taken westward of the line from Great Kills to Point Comfort, 9, or 100 per cent, showed *B. coli* present in 10 c. c.; 7, or 77.7 per cent, showed *B. coli* present in 1 c. c.; and 3, or 33.3 per cent, showed *B. coli* present in 0.1 c. c. In the area east of the line *B. coli* was present in 13, or 100 per cent, of the samples in 1 c. c.; and in 9, or 61.5 per cent, in 0.1 c. c.

At the time of our second examination of this area the temperature of the water had fallen to about 6.5° C., and as a result the scores of the samples of oysters taken indicated a considerably lessened physiological activity of the shellfish. No sample of the 12 examined gave a score over 4.

Fourteen samples of water were taken at this time. *B. coli* was present in 12, or 85.7 per cent, in 10 c. c., and present in 4, or 28.5 per cent, in 1 c. c. Two samples not planted in 10 c. c. quantities were negative for *B. coli* in 1 c. c.

During the second examination two lines of water samples were taken from The Narrows down to Elm Tree Beacon, off the Staten Island shore, with the following results:

Off Fort Wadsworth, flood tide, *B. coli* absent in 0.01 c. c.; off Fort Wadsworth, ebb tide, *B. coli* present in 0.1 c. c.; off South Beach, flood tide, *B. coli* absent in 0.1 c. c.; off South Beach, ebb tide, *B. coli* present in 0.1 c. c.; off Middle Beach, flood tide, *B. coli* present in 0.1 c. c.; off Middle Beach, ebb tide, *B. coli* present in 0.1 c. c.; off Elm Tree Beacon, flood tide, *B. coli* present in 1 c. c.; off Elm Tree Beacon, ebb tide, *B. coli* present in 0.1 c. c.

CONCLUSIONS.

The origin of most of the excessive pollution over the part of this area in which the high scores were found is shown by the float tests U 90 and 88, of the Metropolitan Sewage Commission, shown on map No. 3, and our sanitary survey; and the bacteriological results, when considered in connection with these float results, and with the presence of the large sewer outfall at the foot of Sea View Avenue, justify the conclusion that oysters from the part of this area east of a line drawn south from the west side of the entrance to Great Kills to Point Comfort are subject to an excessive amount of pollution.

The sanitary condition of the oysters from the area west of the line must be considered doubtful during the warmer seasons, and those from the foreshore and near Great Kills should be considered unsafe, unless they be removed to nonpolluted waters until cleansed before being used as food.

While local disposal plants have been provided for the above-mentioned bathing resorts, obviously both decency and sanitary safety require proper purification of sewage from the Sea View Avenue sewer.

CONASKONK POINT (KEYPORT BAR).

SANITARY SURVEY.

The oyster beds on the New Jersey or south side of Raritan Bay are situated on a flat called Keyport Bar, which reaches northward to near the central deep water, nearly opposite Seguine Point. The bar is about 8½ miles west of Sandy Hook and 9 miles southwest of West Bank Light, at the upper end of Swash Channel. They are therefore beyond the range of one flood tide from this section and consequently are not now, nor will they be in the near future, in any danger of pollution from Upper New York Bay.

The beds are 4 miles distant from the mouths of Raritan River and Arthur Kill, but are probably out of the ordinary path of travel of the ebb tide from those streams, as is shown by the float tests, the contour of the bottom, and the bacteriological results obtained. There are, however, two possible sources of pollution on the New Jersey shore—sewage from Keyport and from Matawan.

Keyport sewerage system.—The sewerage system of the city of Keyport[1] covers practically the entire city and has about 400 connections at the present time, with a sewage flow of about 200,000 gallons per day. This sewage is all carried to one disposal plant, located on the shore near the foot of Broad Street (as shown on map No. 4). The sewage passes through either or both of two

[1] Population in 1910, 3,554.

settling tanks 12 by 90 by 7 feet, entering through a distributing trough extending across the end of the tank, and collecting at the outlet end through a similar trough. Suitable baffles and scum

MAP NO. 4

boards extend across the tanks just in front of the troughs to prevent currents through the tanks. Suitable sludge wells are provided with a gasoline-driven triplex pump for lifting the sludge at cleaning periods, either to a disinfecting trough or to a wagon for

hauling it away. The settled sewage, on leaving the tanks, is supposed to be disinfected with a solution of hypochlorite of lime and then led through a mixing chamber, suitably baffled, before it flows out to the bay. Bacteriological examinations of the settled sewage and the effluent from the plant, as well as of samples of water collected from the bay over the submerged outlet, gave the results shown in the following table:

TABLE 4.—*Results of examinations of Keyport sewage and water over disposal plant outlet.*

No.	Date.	Time.	Samples.	Bacteria on agar 37° 48 hours.	B. coli.
					C. c.
1	June 25, 1915	11.15 a. m.	Water over sewer outlet in the bay	50	— 0.1
2	June 26, 1915	9.20 a. m.	do	90	+ 1.0
3	do	9.30 a. m.	Treated sewage	20	— 1.0
4	June 28, 1915	6.30 p. m.	Settled sewage	96,000	+ .001
5	do	do	Treated sewage	3,000	+10.0
6	do	do	Water over sewer outlet	435	+10.0
7	June 29, 1915	do	Settled sewage	77,000	+ .001
8	do	do	Treated sewage	1,150	+ .01
9	do	do	Water over sewer outlet	160	+ 1.0
10	June 30, 1915	8.30 a. m.	do	30	.....
11	July 1, 1915	5 p. m.	Settled sewage	103,000	+ .001
12	do	do	Treated sewage	6,000	+ .01
13	July 2, 1915	6 p. m.	Settled sewage	30,000	+ .0001
14	do	do	Treated sewage	1,060	+ .001
15	July 6, 1915	4.20 p. m.	Settled sewage	58,000	+ .01
16	do	do	Treated sewage	30,000	+ .01
17	July 7, 1915	11.30 a. m.	Settled sewage	180,000	+ .001
18	do	do	Treated sewage	30	+ .01
19	July 10, 1915	10.30 a. m.	Water over sewer outlet	72	+ 1.0
20	Aug. 10, 1915	do	Settled sewage	144,000	+ .001
21	do	do	Treated sewage	6,500	+ .01

A reasonable efficiency of treatment by this plant seems to depend principally upon the vigilance of the operator. One man has been detailed to visit the plant twice each day to make up "hypochlorite" solution and to see that things are working properly. Solutions are made up in two concrete tanks, 3 by 4 by 3 feet. One tank of solution is allowed to stand while the other is being dosed through a lead pipe to the effluent from the septic tank. The strength of the solution and continuous operation vary, of course, with the care of the operator, but frequent visits and analyses by representatives of the State board of health have insured a fair effluent at most times. The valve regulating the discharge of solution, which opens and closes with the varying sewage flow, clogs readily, and on several occasions it was found that no solution at all was feeding through it. Upon complaint of the State board of health an order was issued to the city to remodel the disinfection equipment. Steps are being taken to install a liquid chlorine plant to take the place of the "hypochlorite" arrangement, and in the meantime more frequent visits are being made to the plant by the operator. The proper disinfection of the Keyport sewage is extremely desirable for two reasons: First, the effluent is discharged into

Raritan Bay at a point less than 1½ miles away from the nearest oyster beds, and on ebb tide the effluent is carried out into the bay, passing directly over all the Keyport Bar beds; second, the point of discharge of the effluent is less than one-fourth mile from the mouth of Lupatcong Creek, where practically all the Keyport Bar oysters are floated before they are shipped, and it is possible that on flood tide sewage may be carried, in a very short time, from the point of discharge to the "drinking" ground. This will be discussed more fully further on in the report.[1]

Matawan Creek.—Matawan Creek is a small tidal stream draining about 15 square miles of rather densely populated area. The town of Matawan,[2] the only city of considerable size on the area, has a waterworks plant and a few small factories. It has no public sewer system. The practice of sewering from private places to the creek without any sewage treatment is common, a recent inspection by the State board of health having disclosed 75 sources of pollution of the creek by wastes from human sources. It is estimated that between one-third and one-half of the total population of the city is tributary to private sewers, which discharge into Matawan Creek. This is also true of a considerable floating population, since the hotels and railway station, used by several hundred persons a day during the summer season, are connected to sewers leading to the creek. The points of pollution are 1½ to 2½ miles from the mouth of the creek and 2½ to 3½ miles from the oyster beds. On ebb tide the polluting material, greatly diluted, is carried out toward these beds, and on flood tide some of it may be carried back up Lupatcong Creek, mentioned before, which discharges into a small bay just at the mouth of Matawan Creek.

BACTERIOLOGICAL RESULTS.

Fifty-eight samples of oysters were taken from Conaskonk Point, or Keyport Bar, for examination during our first inspection, from June to September. Of these—

None gave a score of over 50; 2, or 3.4 per cent, gave a score of 50; 9, or 15.3 per cent, gave a score of 41 or more; 13, or 22.1 per cent, gave a score of 23 or more; and 45, or 77.5 per cent, gave a score of less than 23.

Of 56 samples of water taken over the beds—

50, or 89.2 per cent, showed *B. coli* present in 10 c. c.; 31, or 55.3 per cent, showed *B. coli* present in 1 c. c.; and 20, or 35 per cent, showed *B. coli* present in 0.1 c. c.

All of the samples of oysters which scored 41 or more and nearly all of the samples of water which showed a high *B. coli* content were taken when there was high turbidity following rains. As is shown by the tables, the total count of both oysters and water jumped up immediately following the rains of August 1 and August 4.

[1] Page 31.

[2] Population, 1910, 1,646.

Of 21 samples of oysters taken on the writer's second inspection, only 1 scored 14 and 2 as high as 5. Of 20 samples of water over the area, 19, or 95 per cent, showed *B. coli* present in 10 c. c.; 13, or 65 per cent, in 1 c. c.; and 1, or 5 per cent, in 0.1 c. c. Of 7 samples of oysters taken on the joint survey in June, 1916, 1 scored 32, one 14, and the others 5 or less. The water samples showed 4 positive and 2 negative in 1 c. c.[1]

CONCLUSIONS.

On the basis of the sanitary survey and the bacteriological results obtained, it is the writer's opinion that oysters when taken from Conaskonk Point or Keyport Bar are free from dangerous infectious pollution even in the summer season and that bathing in the neighborhood of Keyport is a safe practice, provided that the sewage-disposal plant is efficiently operated and local pollution is prohibited.

LUPATCONG CREEK.

METHODS USED IN "DRINKING" OYSTERS IN LUPATCONG AND CHEESEQUAKE CREEKS.

Practically all oysters taken from Keyport Bar and a large number from other areas in Raritan Bay and elsewhere are freshened or "drinked" for varying periods of time in either Cheesequake Creek or Lupatcong Creek before they are shipped.

The method of "drinking" oysters in Lupatcong Creek differs from that in the Maurice and Cohansey Rivers in southern New Jersey, in Cheesequake Creek, where the oysters are placed on open-slat floats supported by pontoons; and from that at Chincoteague, Va., where there are tight inclosures into which land water and sea water are admitted in the desired proportions. Oysters are transferred from the beds or layings in the open water of Raritan Bay or elsewhere into Lupatcong Creek, where they are scattered over the bottom of the stream, allowed to remain in the less saline waters of the creek for one or more ebb tides, and then taken up and shipped either shucked or "in the shell."

SANITARY SURVEY OF LUPATCONG CREEK.

A few years ago there were several sources of pollution along Lupatcong Creek, a small tidal stream which flows through the western part of the city of Keyport and has a drainage area of about 3 square miles, but a vigorous campaign by the city officials, oystermen, and State board of health has resulted in the removal of practically all privies, stock pens, and drains from the creek. Storm sewers covering a portion of the city discharge street drainage to

[1] For details, see Tables F, G, and H (pp. 93, 94, and 97).

the creek either directly or indirectly, and it is thought by some persons that a few houses have toilets and sinks draining to these storm sewers. A close inspection of that entire portion of the city by Sanitary Engineer Haskins, of this service, a State board of health inspector, and the Mayor of Keyport on July 2 failed to establish any sources of pollution except two hog pens, one privy, and two sink drains along the entire creek. These were ordered removed by the State board of health shortly afterwards, and a subsequent inspection showed that the terms of the order had been carried out. Map No. 4 shows the location of the creek with respect to the city of Keyport, the location of the sewage-disposal plant, and the mouth of Matawan Creek. The location of the oyster houses and "drinking" grounds are also shown.

Float experiments conducted by the New Jersey State Board of Health seemed to show that the effluent which is discharged to the bay from the sewage-disposal plant would not be carried over the "drinking" grounds in Lupatcong Creek on flood tide at the location shown on map No. 4, but would pass the creek mouth and flow up the much larger Matawan Creek. To confirm this, bottle floats were set out by us over the sewer outlet on several different occasions. With a strong wind blowing from the east, the floats all followed the line AB. With the wind from the west, however, of three floats set out at the beginning of flood tide on June 29 near the end of the Ellsworth oyster house pier, as shown at point C, two followed approximately the line CD but the third followed the line CE into the mouth of Lupatcong Creek. Floats set out during the joint survey in June, 1916, followed a similar course, some of them going into Lupatcong Creek.

These results show that it is possible, under certain conditions, for the "drinking" grounds in the creek to be directly polluted by sewage from the city of Keyport, if extreme care is not exercised in the operation of the disposal plant.

BACTERIOLOGICAL RESULTS.

Tables I and J (pp. 98–100) show the results of the examination of 62 samples of water from Lupatcong Creek taken on the first survey. Excluding four samples the *B. coli* content of which was not obtained, of the remaining 58—

B. coli was absent in 4, or 6.8 per cent, in 10 c. c.; present in 5, or 8.6 per cent, in 10 c. c., but not in 1 c. c.; present in 16, or 27.5 per cent, in 1 c. c., but not in 0.1 c. c.; present in 32, or 55.1 per cent, in 0.1 c. c.; and present in 1, or 1.7 per cent, in 0.01 c. c.

Or, in—

54, or 93.1 per cent, *B. coli* was present in 10 c. c.; in 49, or 84.4 per cent, *B. coli* was present in 1 c. c.; in 33, or 56.8 per cent, *B. coli* was present in 0.1 c. c.; and in 1, or 1.7 per cent, *B. coli* was present in 0.01 c. c.

Of 19 samples of oysters examined at the same time after they had been deposited on the bottom of Lupatcong Creek for one or more tides (see Table I), one had a score of 410; one a score of 230; two had scores of 140; five scored 50; one scored 41; three, 32; two, 23; and four, 14 or less. Or, 21 per cent had scores of 140 or more and 47.3 per cent scores of 50 or more. It should be noted, however, that all samples scoring over 50 were collected at a time when the turbidity was high, following heavy rains.

During the second examination in November six samples of oysters floated in Lupatcong Creek for two to three days, with the temperature of the water ranging from 6° to 8°, were examined. Of these, one scored 50; one, 41; one, 32; two, 23; and one, 5.

Eleven more samples of water were taken on the joint survey in June, 1916. Of these, 4 were negative for *B. coli* in 1 c. c., 1 positive in 1 c. c., 5 positive in 0.1, and 1 positive in 0.01. Four samples of floated oysters taken at the time scored 1, 140, 230, and 500, respectively.

CONCLUSIONS.

Lupatcong Creek will undoubtedly be subject to possible infectious pollution so long as the operation of the sewage-disposal plant at Keyport is not reliable and pollution is discharged from Matawan Creek. Unquestionably the floating of oysters in any creek which runs alongside or through a town is fraught with potential danger, and such a practice should be discouraged by those responsible for the health of the people.

CHEESEQUAKE CREEK.

SANITARY SURVEY.

Cheesequake Creek is a tidal stream draining about 3 or 4 square miles of territory with an extremely small population. For a considerable distance on each side of the stream the land is flat and marshy, and, except near its mouth, there are practically no houses along its banks. This creek is utilized for "drinking" or floating many of the oysters taken from Raritan Bay and some from other localities. Near its mouth the creek is crossed by the New York & Long Branch Railway, by a public highway, and by a trolley line. Morgan is a small settlement near the mouth of the stream which is not inhabited to any extent except in the summer. On the beach just at the mouth of the creek there is a tent colony during the summer, and a few hundred yards back from the creek there are a few cottages and restaurants.

A close inspection of the creek on July 31 revealed two sources of pollution—one a toilet in a house overhanging the creek just west

of the railroad bridge, and the other an overhanging privy serving a small restaurant and a houseboat, also near the railroad bridge. Later both of these were ordered by the State board of health to be removed. The "drinking" grounds lie about one-half mile upstream from the settlement and extend for some distance along the creek. In the neighborhood of these grounds there is not a habitation of any kind. The mouth of the creek is located about 2¼ miles south of the sewer outlet of South Amboy and 3¼ miles northwest of the sewer outlet of Keyport. It is clear away from the direction of flow of any polluting stream or current.

Large quantities of stable manure are carried on barges from the city to a landing about a mile or more above the mouth of the creek and above the floating grounds for oysters. Large piles of this manure are seen on the fields near by, rotting and being prepared for use as fertilizer.

BACTERIOLOGICAL RESULTS.[1]

Of the four samples of oysters taken during our first examination of Cheesequake Creek only one scored as high as 14 after having been floated therein. During the reexamination of June, 1916, two more samples of floated oysters were taken, one of which scored 23 and the other 3. Of the 10 samples of water taken during 1915, all showed *B. coli* present in 1 c. c., but in no smaller quantities, while of the 14 samples taken in June, 1916, one sample showed *B. coli* present in one-tenth c. c., but no smaller quantities, and six showed the organism absent in the same quantity. The comparatively high colon score obtained was undoubtedly due to the traffic in manure already described, and such colon findings are without sanitary significance from a public-health standpoint.

CONCLUSIONS.

In the absence of any source of pollution from human sources and the known presence of stable manure, it is our opinion that from a sanitary standpoint this creek is a safe and good one for the purpose of floating shellfish. It is possible, however, that oysters shipped therefrom might sometimes show high bacteriological scores, which, in the absence of knowledge as to their source, might result in their condemnation under the present system of inspection and condemnation of shellfish by food authorities. In fact, this creek serves as a good example of the futility of endeavoring to establish the sanitary safety of shellfish by laboratory methods alone.

It may be stated here that, following the results obtained by the Public Health Service, the State of New Jersey, the Bureau of Chem-

[1] See Table K (p. 102).

istry, and the city of New York in June, 1916, it was determined by the City Health Department of New York to prohibit the shipment into the city of oysters floated in this creek; while a former decision prohibiting the importation of oysters from Keyport Bar was reversed. It was the unanimous decision of all parties interested that the floating of oysters in Lupatcong Creek was unsafe.

OTHER CREEKS ON THE SOUTH SHORE OF RARITAN BAY.

It is asserted by the oyster growers and others interested in the shellfish industry on the south shore of Lower New York Bay that the shellfish grown in that vicinity are not marketable without first being floated for the purpose of cleansing the oysters from sand, and, incidentally, giving them the appearance of being fattened.

In view of the decision of the Bureau of Chemistry and the city authorities of New York to forbid the shipment of oysters floated in Lupatcong or Cheesequake Creeks, a preliminary survey was made by the writer, in cooperation with representatives of the State Department of Health of New Jersey, of all of the creeks on the south shore which seemed suitable, with a view to finding if possible some creek free from dangerous pollution.

WHALE CREEK.

Whale Creek is a small estuary about half a mile west from Matawan Point at the entrance to Matawan Creek. The bacteriological findings varied from *B. coli* present in 0.1 c. c. in two samples and present in 1 c. c. in three samples near the mouth of the creek, to *B. coli* absent in 1 c. c. quantities in four samples in the upper part of the creek. The sanitary survey indicated that the creek is not to be recommended for the floating of shellfish because there is at least potential danger of infection incident to the more or less uncontrollable population upon its watershed; further, the fresh water is almost entirely surface drainage, varying greatly from time to time in character and pollution, usually carrying considerable clay. The creek is otherwise unsuitable for floating purposes.

CONASKONK CREEK.

This creek empties into Raritan Bay about halfway between Keyport and Conaskonk Point. Of twelve samples of water taken at intervals from a pond at the head of the creek, all of the samples showed *B. coli* present in 1 c. c., 10 of the samples showed its presence in 0.1 c. c., and two of the samples showed the organism present in 0.01 c. c. This creek is not recommended for floating of shellfish, as the sanitary survey shows that its head waters are liable to pollution consequent upon close proximity to human habitations in the

easterly end of Keyport; furthermore, it is not suitable for such a purpose because of its narrowness and the bar in front of its mouth.

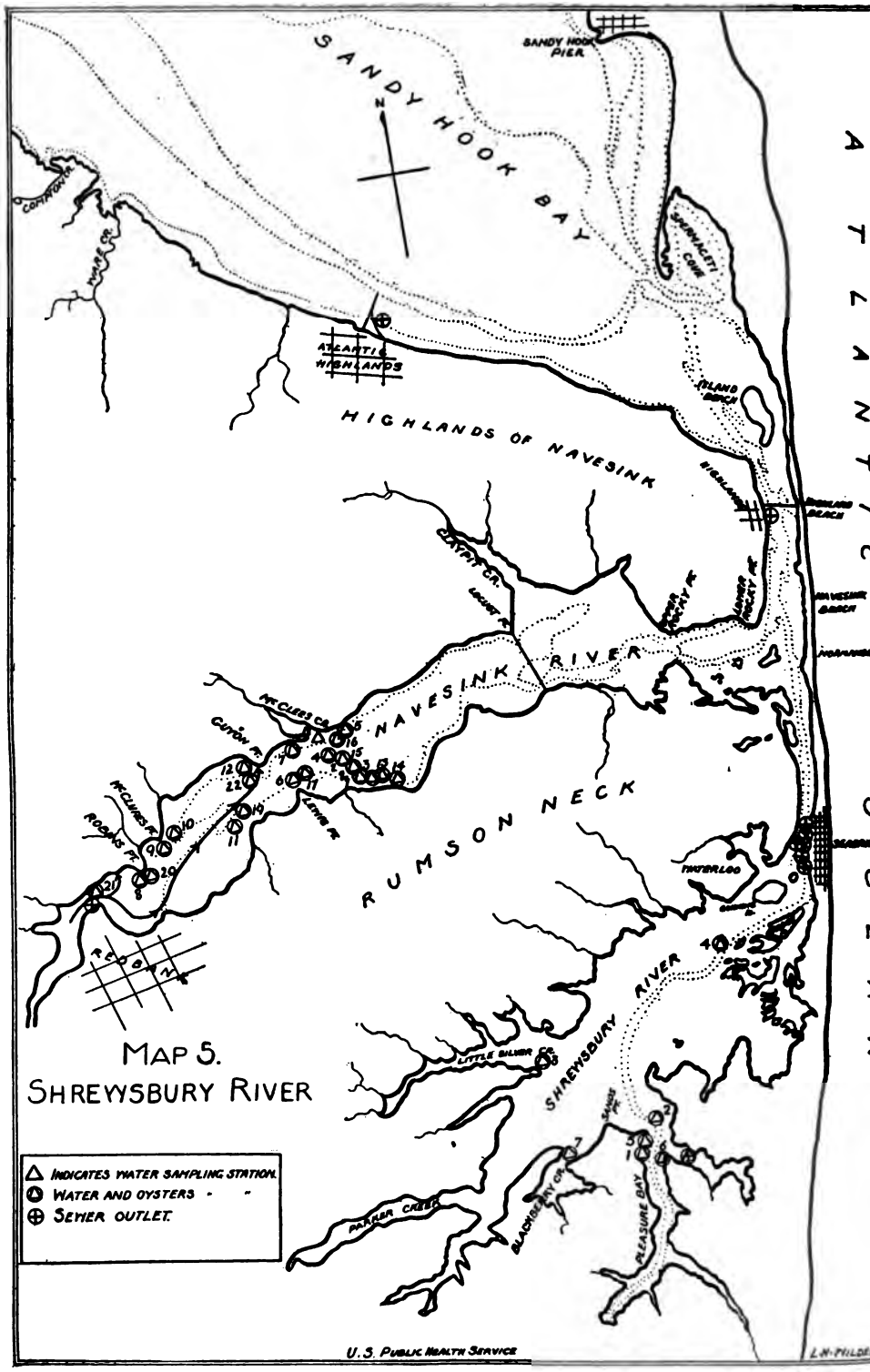
FLAT CREEK.

This creek discharges into the bight between Conaskonk Point and Point Comfort. Of the ten samples of water taken in this creek at various stages of the tide, all but three showed *B. coli* present in 0.1 c. c. The sanitary survey of the creek would seem to indicate that it could be made suitable for the floating of shellfish by the elimination of several easily corrected sources of pollution. A pigsty was found located upon the edge of the steep bank of a fresh-water pond at the head of the creek, the pollution from which could affect the bacteriological findings at ebb tide. Near its mouth there is a small stream which empties into the bay, the waters of which showed *B. coli* present in 0.01 c. c. This latter creek receives some pollution from a brickyard.

SOUTH SHORE OF LOWER NEW YORK BAY.

An inspection of the south and west shore of the Lower Bay was made, but no pollutions were discovered beyond those already mentioned. From Keyport east to Atlantic Highlands there are no communities of importance other than the beach resort at Keansburg. No sewers enter the bay at this point. At Atlantic Highlands [1] the city sewer system, with about 500 connections, discharges approximately 50,000 gallons of sewage daily directly into Sandy Hook Bay within less than a mile of extensive clamming areas. This city was ordered by the State board of health to construct a sewage disposal plant a few years ago, but to date nothing has been done. There are a few isolated connections to Many Mind Creek, and there are toilets at the end of the pier of the Central Railroad of New Jersey serving only 30 or 40 employees. A great deal of complaint has been made about the discharge of sewage and garbage from excursion steamers entering here, but it is probable that the total quantity from this source is negligible compared to the sewage from the city and the great dilution afforded by the bay. The taking of clams from the foreshore and vicinity of the above outfalls and the bathing in such waters are certainly not safe, and should be prohibited.

[1] Winter population, 1910, 1,645; summer population, estimated, 5,000.


SANDY HOOK BAY
SANDY HOOK PIER
ATLANTIC OCEAN
HIGHLANDS OF NAVESINK
NAVESINK RIVER
RUMSON NECK
SHREWSBURY RIVER
LITTLE SILVER
PARKER CREEK
PLEASURE BAY
ATLANTIC HIGHLANDS
MAP 5.
SHREWSBURY RIVER
INDICATES WATER SAMPLING STATION.
WATER AND OYSTERS
SEWER OUTLET.
U. S. PUBLIC HEALTH SERVICE
L.H. MILDER

SHREWSBURY AND NAVESINK RIVERS.[1]

SANITARY SURVEY.

SHREWSBURY RIVER.

The Shrewsbury River rises near Long Branch, N. J., and flows northeasterly to Rumson, where it joins the Navesink. It is a tidal stream, with a drainage area of about 29 square miles. The sewage from Long Branch, the largest city on the watershed, is discharged directly into the sea. There are a great many private sewers and other sources of pollution which discharge into the various branches or tidal bays of the river, but public sewers of only two municipalities discharge into the stream. Seabright, with a winter population of 1,220 in 1910 and a summer population of several thousand, has a system of sewers discharging into the river at the foot of practically every street, in addition to which there are several private sewers. None of the sewage is treated.

Rumson, across the Shrewsbury River from Seabright, has a system of sewers, with a disposal system which consists of sedimentation tanks and hypochlorite of lime disinfection. There are several sewers from residences in the immediate neighborhood of the sewage disposal plant discharging sewage into the river without treatment. It is estimated that the flow from the city sewers amounts to about 50,000 gallons per day. It was impossible to obtain an estimate of the flow or number of connections to the sewer system at Seabright. Monmouth Beach has under construction a system of storm sewers discharging into the river near Pleasure Bay. It was stated by several persons that there are many house connections to this system, and the appearance of the effluent bore out these statements. The practice of constructing private sewers to the river seems to be generally followed where convenient.

NAVESINK RIVER.

Navesink River rises near Freehold and flows northeasterly about 17 miles to Sandy Hook Bay. It is joined at Rumson by the Shrewsbury River. It has a drainage area of about 95 square miles, and an average fresh-water flow of about 98,850,000 gallons per day, not including the discharge of the Shrewsbury. The river is tidal to Red Bank (for about 7 miles). The drainage area is quite populous, but the city of Red Bank[2] is the only place discharging sewage into the river. Red Bank has about 8 miles of sanitary sewers, with a

[1] See Map No. 5.

[2] Population, 1910, 7,398.

flow of about 300,000 gallons per day. It is estimated that about 60 per cent of the population of the city is connected with the system. The sewage flows to a disposal plant, consisting of grit chambers, septic tank, and hypochlorite of lime disinfection, before being discharged into the river, near the head of tidewater. An attendant with no other duties is provided for this plant, which seems to be quite well operated.

Results of analyses of treated sewage made by the New Jersey State board of health, along with bacteriological examinations of the raw and treated sewage made by the Public Health Service party are shown in the following table:

TABLE No. 5.—*Red Bank sewage.*

Date.	B. coli per c. c.	Hypochlorite.
		p. p. m.
Dec. 16, 1913	10,000	8.3
June 2, 1914	10,000	8.5
July 18, 1914	10,000	9.0
Aug. 6, 1914	100,000	8.5
Sept. 4, 1914	10,000	10.3
Oct. 8, 1914	100,000	10.5
Apr. 8, 1915	1,000	11.0
Feb. 19, 1915	1,000	11.5
June 24, 1915	50,000	4.5

	Bacteria per c. c., agar 37° 48 hours.	B. coli present in —
July 7, 1915.		
Treated sewage	1,500	+0.1
Raw sewage	200,000	+ .01
July 8, 1915.		
Treated sewage	320	+10.0
Raw sewage	290,000	+ .0

Oysters are found in the Navesink River as far up as the sewage disposal plant, but the most of them are a few miles down the stream. In order to determine whether or not sewage from the disposal plant would be carried as far as the main beds in one ebb tide, a float was started opposite the disposal plant at high tide July 8, at 6.25 a. m. A light breeze was blowing from the south. At 8 a. m. this float was blown to the north shore and was reset in the main channel opposite the yacht club. At 12.30 the wind was blowing hard from the south and the float was again blown to the shore 2 miles downstream from the starting point. If time were taken out for that lost in taking up and resetting the float at 8 o'clock and that lost in finding it at noon, it is believed the rate of actual travel would have been sufficient to carry it to Fairhaven. On a normal day there is little doubt but that the effluent from the Red Bank disposal system would be carried over the entire shellfish area between the point

of discharge and the junction of the river with the Shrewsbury. This float test is shown on the map of this area.[1]

A close inspection of both shores of the Navesink disclosed two private sewers reaching the river from residences in Red Bank and one along the shore from Red Bank to Rumson. Two overhanging privies were found in the same area. From Seabright to Highlands there were four sewers from residences. At Highlands on both sides of the stream, as well as from many houses on the west shore, sewers from the restaurants and hotels were discharging directly to the river. At this point many house boats and small yachts anchor during the summer season, and there is undoubtedly a great amount of pollution from that source. The population reaches several thousand during the summer season at this resort, and it appeared that the greater part of the sewage was discharged in the vicinity of the "inside" bathing beaches. While there are no shellfish in the immediate vicinity, the danger from this source to clams in Sandy Hook Bay and shellfish in both Shrewsbury and Navesink River must eventually be of an appreciable magnitude. Below Highlands a septic tank serving 40 or 50 persons at Waterwitch discharges a particularly offensive effluent into an arm of Sandy Hook Bay. From this point to Atlantic Highlands no sources of pollution were found.

BACTERIOLOGICAL EXAMINATIONS

A number of samples of oysters and water were taken over the shellfish areas in both streams.

Of 21 samples of oysters taken from the beds of Navesink River—

2, or 9.5 per cent, scored 32; 3, or 14.3 per cent, scored 23, and none of the remainder scored over 5.

Of the same number of water samples, 19 of which were taken with the oysters—

All showed *B. coli* present in 10 c. c.

13, or 61.9 per cent, showed *B. coli* present in 1 c. c.; 3, or 14.3 per cent, showed *B. coli* present in 0.1 c. c.

In the Shrewsbury River four samples of oysters and clams were taken in Pleasure Bay, along with the same number of samples of water. The oysters gave scores of 23 and 14, while each of the clams scored 2. Of the four water samples—

All, or 100 per cent, showed *B. coli* present in 10 c. c.; 3, or 75 per cent, showed *B. coli* present in 1 c. c.; 1, or 25 per cent, showed *B. coli* present in 0.1 c. c.

A sample of oysters from Little Silver Creek scored only 3, with the water positive for *B. coli* in 1 c. c.

Oysters from Blackberry Creek scored 2, and the water showed *B. coli* present in 10 c. c.

[1] Map No. 5.

A sample of clams from near Gunning Island scored 3, with the water positive for *B. coli* in 10 c.c.

Results of examinations of Navesink and Shrewsbury Rivers are shown in Tables L and M (pp. 103 and 104).

CONCLUSIONS.

Under winter conditions, when there are few boats on the Navesink River and there is no summer population near the mouth of the stream at Highlands, there will be little danger of pollution of the shellfish beds from about Guyon Point down toward Oceanic, and it is believed that the oysters and clams from this vicinity will be safe, provided that the disposal plant at Red Bank is efficiently operated.

During the summer the number of persons who contribute pollution from boats and directly from the shores is so large that it is believed that shellfish from this area should not be used raw.

Bathing in the waters adjacent to the inlet and at the inside bathing beaches near Highlands must under existing conditions be considered unsafe as well as uncleanly.

There are few oysters in the Shrewsbury River and the dilution is enormous. It is evident, however, that shellfish from the south bank and Pleasure Bay are subject to pollution and should not be used for food. The small areas around Blackberry and Little Silver Creeks appear to be free from danger of serious pollution. Clams from near the mouth of the river and from around Gunning and Sedge Islands are subject to pollution from Seabright and are unsafe, more particularly during the summer season.

SANITARY CONDITIONS IN RARITAN BAY AS A WHOLE.

It is evident from the sanitary survey and from the bacteriological results obtained that no part of this bay can be considered entirely unpolluted. There is, however, in the light of present knowledge, no reasonable evidence which would justify at present the condemnation of all shellfish-bearing areas in the bay; though it should be borne in mind that the amount of pollution is being constantly augmented as the result of the growth of the present contributing communities and that it will probably be enormously increased when the Passaic Valley sewer is completed.

The tidal and current studies have shown that the time factor, or interval between discharge of sewage and its arrival over the oyster beds, is not great. Therefore dilution, which is very great in some sections of the bay, must be regarded as the most important determining factor of safety.

The pollution in the bay is chiefly urban in origin, hence in large part from human sources, and therefore potentially dangerous.

Decision as to the sanitary safeness of any section of the bay therefore must be based upon the amount of pollution present as measured by the *B. coli* content, together with proximity of such section to possible sources of intermittent infectious pollution.

Shellfish from foreshores, particularly in the immediate vicinity of sewer outfalls, or even of communities without sewers, are generally to be condemned as raw food. Such localities, even where repeated examinations fail to show large amounts of pollution, may be subject to sudden, intermittent, and dangerous infectious pollution, and to such infections have been traced most of the typhoid fever outbreaks consequent upon eating infected shellfish.

Areas in open waters away from such dangers, away from the channel drift from New York and other sources of pollution are different from the above; in some of them the amount of pollution is small and its character fairly constant. After thorough study over a considerable period of time both these factors can be predicted. The evidence pointing to infectious disease being carried by shellfish from these latter areas is at least indefinite. Inasmuch as purification of oysters by the use of hypochlorite of lime, or chlorin, however, has been shown by the Service after experimentation at Fisherman's Island,[1] to be possible and to be of practical value in Jamaica Bay, it is believed particularly applicable to shellfish from most of the sections of Raritan Bay and is recommended for adoption.

While our observations at Fisherman's Island and elsewhere, and those of other investigators, have shown conclusively that oysters admit some water even during so-called hibernation periods, nevertheless their activity during such period is lessened, the quantity of water taken in is greatly decreased, and hence there is diminished danger of infection even though the water contain pollution. There are oyster-bearing areas, therefore, the shellfish from which are unfit for use as raw food during warm seasons when active feeding results in the accumulation of organic matter, including bacteria, both within the oyster and in its liquor, but from such areas oysters may be eaten with impunity during hibernation. We do not believe, however, that oysters from all polluted beds are safe during such periods even if bacteriological results therefrom fail to show heavy pollution; there is, in our opinion, potential danger at all times in oysters from grossly polluted waters and in those from localities liable to pollution perhaps small in amount but recent and infectious in character.

Before areas are declared safe because of hibernation, the fact of its existence should be determined by actual observation. The opening of such areas by date instead of observation of existing temperatures would be unsafe.

[1] See Wells, Reprint 351 from Public Health Reports.

ATLANTIC COAST OF NEW JERSEY.[1]

Almost the entire coast of New Jersey from Sandy Hook to Cape May consists of narrow, low-lying, sandy islands or beaches, separated from the mainland by wide areas of marshes and by shallow bays or sounds connected with each other by intricate and tortuous thoroughfares, and with the Atlantic Ocean by inlets which break through the beach at irregular intervals.

The whole beach is occupied by a succession of seaside resorts, which vary in size from such a great community as Atlantic City to small groups of summer cottages. Since the principal attraction of these resorts is the ocean beach, the almost universal custom is to discharge sewage and other wastes into the thoroughfares or bays.

There are few rivers of large size which discharge into these waters, and the salinity of the water is such that conditions are extremely favorable for the growth of oysters and other shellfish—especially the hard clam, or quahog, and soft clam. Notwithstanding this, however, the oyster industry on this coast has apparently declined in recent years, and many areas formerly occupied were found barren and abandoned.

FROM CAPE MAY TO ATLANTIC CITY.

COLD SPRING HARBOR.

Proceeding up the coast from Cape May, the southern extremity of New Jersey, the first body of water encountered is Cold Spring Harbor. The only community of any size in this neighborhood is Cape May City, which is a summer resort with a winter population of 2,471 and a summer population of about 12,000. Formerly the sewage from a part of the city was discharged into Cape Island Creek, which is a tributary of Cold Spring Harbor; but recently extensive additions to the city have been laid out, which are furnished with a complete sewerage system. While about 65 per cent of the sewage from the entire city is collected at one point and pumped into Delaware Bay near the Bay Shore Life Saving Station, the remaining 35 per cent still goes untreated into Cape Island Creek. There are no records, but it is estimated by the city engineer that about 95 per cent of the houses are connected to the sewerage system.

Cold Spring Harbor has recently been dredged and the oyster beds appear to have been destroyed. At present there are few oysters or clams taken from it. Oysters known as "Cape May Salts" are unfreshened oysters from any of the near-by waters.

[1] See Tables N, O, and P, (pp. 105, 107, and 108).

JARVIS SOUND.

Jarvis Sound is just north of Cold Spring Harbor, with which it is connected by a part of the inland waterway. Formerly the seat of an important oyster industry, the beds now appear to be abandoned and covered with "sea cabbage." Samples of water showed no evidence of pollution, and there are no sources of pollution nearby.

TAYLOR SOUND.

Taylor Sound is a smaller shallow area lying northwest of Jarvis Sound and nearly opposite Turtle Gut Inlet, which opens to the ocean. There are rather extensive private beds in this sound, and the sanitary survey and examinations of oysters and water showed no danger from pollution. A sample of oysters in this area scored 2. One sample of clams taken in Swan Channel, a part of the inland waterway which connects Taylor Sound with the inlet, scored 1.

VICINITY OF FIVE MILE BEACH.

Just north of Turtle Gut Inlet and between this inlet and Hereford Inlet is an island known as "Five Mile Beach," on which are the resorts known as Wildwood Crest, Holly Beach, Wildwood, North Wildwood, and Anglesea. These towns form one continuous community which occupies practically the whole beach. The total winter population in 1910 was 3,735, but there has been a rapid increase in the permanent population, which now approximates 8,000.

This is the most popular summer resort for transients south of Atlantic City, the number of excursionists having been as high as 70,000 in a single day. These communities all have complete sewerage systems, with several separate outlets into Post Creek, Grassy Sound, and Beach Thoroughfare. It is estimated that there are about 4,300 sewer connections. At present none of the sewage is treated, but several disposal systems are under consideration.

About 25 or 30 houses along Post Creek and Grassy Sound Channel have overhanging privies. There is a small private oyster bed within a few hundred feet of the large sewer outlet under the wagon bridge at Wildwood, and the State health department has very wisely ordered that it be no longer used. Oysters from this bed are liable to dangerous pollution.

Of 10 samples of water taken by us in Grassy Sound Channel all gave *B. coli*, confirmed, in 1 c. c., and 7 in 0.1 c. c. Of 10 samples taken in Grassy Sound, 7 gave *B. coli* in 1 c. c., 4 in 0.1 c. c., and 1 in 0.01 c. c. It was not considered necessary to secure samples in Post Creek, which is clearly heavily polluted.

Conclusions.—In view of the large amount of untreated sewage discharged into Grassy Sound Channel and Grassy Sound, the shellfish

areas in this vicinity are unsafe. Few shellfish are shipped from the areas, but large quantities are consumed by visitors who come from all parts of the country. The conditions are worse in the summer because of both the increased quantity of sewage and the increased physiological activities of shellfish.

RICHARDSON BAY.

Richardson Bay is a shallow body of water connected with Turtle Gut Inlet by Richardson Channel and with Grassy Sound Channel by several narrow guts. There are no sources of pollution in this neighborhood and no oysters were found. Clams are taken from this locality in considerable quantities.

JENKINS SOUND.

Jenkins Sound lies opposite Hereford Inlet and receives water through several channels. A sample of oysters from this area scored 2. Of 10 samples of water, all were negative for *B. coli* in 1 c. c., the largest quantity planted. There are considerable quantities of shellfish shipped from this sound, which is free from pollution.

GREAT SOUND AND VICINITY.

Great Sound is a large shallow body of water opening into Hereford Inlet through Great Channel, the opening being about 3 miles above Stone Harbor.

Stites Sound and Townsend Sound are connected with the ocean by South Channel and Main Channel, which open into Townsend Inlet. All of these bodies of water are free from dangerous pollution.

The principal sources of pollution are Stone Harbor, Peermont, and Avalon, resorts on the beach between Hereford Inlet to the south and Townsend Inlet to the north.

Stone Harbor has a permanent population of 1,200, which is much augmented during the summer by cottagers. There is a complete sewerage system, owned by a corporation, to which there are connected 375 houses, practically all on the town site. The sewage is treated in two plants by sedimentation and disinfection with hypochlorite of lime before being discharged into Great Channel, which leads from Hereford Inlet to Great Sound. The disposal plants are efficiently operated.

Avalon and Peermont form one community of about 300 winter and 1,500 summer population. There are about 250 connections to the sewer system from Avalon and Peermont. There are about 20 houses not so connected.

Sewage from the public system enters Ingram Thoroughfare through several outlets, but a disposal plant now under construction is designed

to treat this sewage by sedimentation and disinfection before final discharge into the thoroughfare.

LUDLAM BAY AND VICINITY.

Townsend Inlet, Sea Isle City, Whale Beach, and Corson Inlet are small resorts on Ludlam Beach, which extends from Townsend Inlet to Corson Inlet, east of Ludlam Bay, and tributary thoroughfares.

Sea Isle City has a permanent population of 550 and a summer population of 5,000 to 6,000. The city is completely sewered, with 350 connections. The sewage is discharged untreated into Ludlam Thoroughfare and Bay. A disposal plant designed to treat the sewage by sedimentation and disinfection by hypochlorite of lime was constructed by the city about two years ago, but on account of litigation concerning ownership, it is not in use. Houses at Whale Beach and Corson Inlet are equipped with cesspools.

There are said to be no oysters in Ludlam Bay; which lies west of Sea Isle City and is connected with the ocean by Main Channel and Corson Inlet. Shellfish from the area will be unsafe so long as the sewage of Sea Island City is untreated.

VICINITY OF PECK BEACH.

Peck Beach has the Atlantic Ocean on the east, Great Egg Harbor on the west, and Great Egg Inlet, connecting the latter two, on the north.

Ocean City is a large resort on the north end of the beach with a winter population of 2,000 and a summer population at times approximating 30,000. There is a complete sewerage system with 1,800 connections and a disposal plant which consists of a septic tank and disinfection with hypochlorite of lime. The effluent is discharged into Great Egg Harbor near the inlet. There are clam beds in the immediate vicinity of the disposal plant outfall and men were observed clamming there. Despite the dilution and the previous treatment of the sewage, the taking of clams from the immediate vicinity of the outfall should be prohibited. The Annual Report of the State Board of Health of New Jersey for 1910 (p. 128) contains the account of an investigation of an outbreak of typhoid fever apparently due to the ingestion of raw clams taken from the vicinity of a sewer in Ocean City.[1]

Somers Point is a community on Great Egg Harbor on the mainland opposite Ocean City. There are no sewers except one or two from private places.

The shellfish industry here is an important one. Clams are shipped by one dealer who stores them in a pen without "drinking." Large quantities of oysters are grown in the southwestern section of the

[1] See Appendix III, p. 143.

harbor and carried to English Creek, where the water is of less salinity, to be shipped at once or after "drinking."

There are no houses on or near English Creek and sanitary conditions are excellent both there and over the oyster beds.

VICINITY OF ATLANTIC CITY.

Between Great Egg Inlet on the south and Absecon Inlet to the north lies an island or section of "The Beach" about 8 miles long, on which is the greatest seaside resort in America. Beach Thoroughfare, that portion of the inland waterway which separates this island from the mainland marshes, connects Great Egg Inlet and Absecon Inlet. Longport, Margate City, Ventnor, and Atlantic City are four municipalities which together are generally included under the one name, Atlantic City.

The combined permanent population of this community exceeds 50,000, while the transient population at times augments this number to 300,000 or even more.

Longport borough, on Great Egg Inlet, Risley Channel, and the ocean, has a complete sewerage system to which every house in the town is connected. There are two disposal plants for sedimentation and treatment with hypochlorite of lime, the final effluent being discharged into Risley Channel.

Margate City, immediately to the north, also has complete connections to a sewerage system with two plants similar to those of Longport, the effluents from which are discharged into Beach Thoroughfare.

Ventnor, between Margate and Atlantic City, has a complete sewer system with about 907 connections. The sewage was formerly treated in two small plants similar to those previously described, the effluent having been discharged into the "Inside Thoroughfare." There is now being constructed on the marsh of Beach Thoroughfare, about 2 miles from the city, a disposal plant, which consists of coarse screens, Imhoff tanks, liquid chlorine disinfection apparatus and tidal storage chambers.

Atlantic City has a complete sewerage system owned by a private corporation and practically every house, about 7,000, is connected with the 70 miles of sewers. The sewage from the main section of the city flows to a storage basin at Baltic Avenue, from which it is pumped untreated to Beach Thoroughfare, about 3 miles from Absecon Inlet.

A disposal plant in which the sewage is to pass through three sets of screens, the openings ranging from $\frac{1}{2}$ to $\frac{1}{40}$ of an inch, and be treated with liquid chlorine, is under construction.

That small district of Atlantic City known as Chelsea is served by a disposal plant which consists of equipment for sedimentation and

disinfection with hypochlorite of lime, the effluent being discharged into the "Inside Thoroughfare," a narrow blind waterway which runs, a few squares behind the ocean beach, from Margate, about 4 miles southward to Beach Thoroughfare, behind Atlantic City; this waterway is only 200 to 300 feet wide and many houses overhang the bank of the stream on the side next to the city. A mile below its head Ventnor Channel stretches at a right angle to Beach Thoroughfare, near Lake Bay.

Besides the waterways described there are many other tortuous creeks and "guts" in the marshes behind Atlantic City.

There appear to be few if any oysters growing within this area, which, however, seems to be very prolific of clams, both hard and soft; and during the summer season many are taken from the area for local consumption, as well as for fish bait.

The State department of health, as a result of an examination of shellfish and water from this area, has defined limits within which "the taking of oysters, clams and other shellfish from these waters or having in possession with intent to distribute or sell them" is prohibited.

Dr. Guion, for years the city health officer of Atlantic City, reported (Proceedings Thirtieth Annual Meeting of the New Jersey Sanitary Association) that in 1903 there were 75,500 bushels of oysters and 3,820,000 clams consumed in Atlantic City. There were 20,000 bushels of oysters and 5,240,000 clams shipped to other points. Most of this product was brought in by boat from local waters within a radius of 10 miles; 87,000 bushels of oysters and 8,915,000 clams having been thus obtained. The remainder of the total yearly traffic was shipped in by rail, and 60 per cent of the oysters and 70 per cent of the clams are handled in the seven warm months of the year. He states: "The original source of these oysters are unpolluted; 25,000 bushels come from Eagle and Grassy Bays, 14,000 bushels from Absecon and Lake Bays, and 53,000 bushels from Great Bay."

The prohibited area is: Beach Thoroughfare from its mouth at Absecon Inlet to the Boulevard Bridge; Great Thoroughfare to the Boulevard Bridge over that water; all of "Inside Thoroughfare;" all of Ventnor Canal; all of Clam Creek and its tributaries; and all of Clam Thoroughfare. As a result of the Public Health Service investigation the action of the State department is thoroughly approved and the location of the limits are believed to have been judiciously selected. In one or two instances during this investigation men were found taking clams which they asserted were to be used as bait. It is believed that some clams are still taken and sold for food, but the quantity is probably small.

The importance of eliminating every factor in the spread of infectious diseases is obvious, in addition to which the enormous amount

of money invested in hotels and boarding houses in Atlantic City is so much greater than the value of the shellfish industry that the latter hardly need be considered, and there is every reason to hope that energetic police measures will be continued toward eliminating the danger of infectious disease through the taking of shellfish from this area. Several years ago a small outbreak of typhoid fever occurred which was thought to have been caused by eating shellfish from the heavily polluted waters near the sewer outfall. This outbreak was investigated by Snow, Guion, and others and a comprehensive report made.

LAKE BAY.

Lake Bay is a body of water about 3 miles inland from Atlantic City. To the northeast it receives Great Thoroughfare, which is about 3 miles long, and joins Beach Thoroughfare behind Atlantic City. To the southeast Beach Thoroughfare is merged into Lake Bay by an area known as Shelter Bay. Most of the tidal flow is by way of Beach Thoroughfare and Risley Channel to Great Egg Inlet.

Pleasantville is a town with 4,390 population on the mainland or west side of Lake Bay. The town has no sewers. The shellfish industry is a large one, engaging about 150 persons. It is believed that no sewage from Atlantic City ever reaches this water and a sample of oyster taken from beds nearest Great Thoroughfare and Ventnor Canal gave a score of only 1. Of 5 samples of water taken in the open area, all were negative for *B. coli* in 1 c. c., the largest quantity tested.

A large part of the oyster industry consists in removing the shellfish from their layings to long artificial ditches which have been dug up into marshy areas adjoining Pleasantville. The salinity of the tidal water in these drains is considerably reduced on ebb tide by the fresh water which seeps from the marshes and from small streams or ditches which extend a half mile or so inland. Oysters are left on platforms on the bottoms, covered by sheds, for one or more tides for the purpose of cleansing and "drinking," during which process their bulk is increased and salinity lessened. All oysters are shipped in the shell and the market extends to many inland cities of Pennsylvania. Three of these creeks were being used at the time of this inspection. One sample of oysters was taken from each "drinking" place—one of which gave a score of 4, and the others 0.

Of 15 water samples 9 were positive in 1 c. c. and 4 in 0.1 c. c. Within 25 or 30 feet from the eastern or Mathis oyster house there was an open-surface privy, which constitutes a constant menace to oysters floated in the near-by ditch. In addition to this menace it is believed that drainage from a large steam laundry enters the stream. This ditch will be a constant danger, and proper authority should cause the immediate removal of the privy. Attention of the State

board of health was directed to the condition. The other ditches and houses were in good sanitary condition.

A sewer carrying the waste water only from the Risley Laundry empties into a creek, about one-half mile from Lake Bay, the creek discharging within a few hundred feet from the oyster area. It was stated at the laundry that no sanitary sewage reached this drain, the employees using a sanitary toilet provided for them.

ABOVE LAKE BAY.

ABSECON BAY.

Absecon Bay lies north of Lake Bay and is connected with the ocean by Main Channel and Absecon Inlet. A small creek called Absecon Creek, fed by springs and by surplus water from the Atlantic City Water Works near by, enters the bay from the west. Along the creek lies the village of Absecon; below, along the marshy bank of the creek, are four or five oyster shipping houses, in front of each of which are one or more oyster floats, in which oysters from the layings in the bay are kept for "drinking" and convenience in shipping.

A close inspection of the creek revealed no source of pollution of any sort except a storm sewer draining a portion of the village streets, and an open, dirty, surface privy within 25 feet of the lowest oyster house.

Of 10 samples of water taken in the creek only one was positive for *B. coli* in 1 c. c.

Of three samples of oysters taken from the floats one gave a score of 0, one a score of 1, and one a score of 2. Two samples taken from the bay gave scores of 0 and 2, respectively. The attention of the State board of health was directed to the privy.

GREAT BAY.

Great Bay is a shallow body of water about 3½ miles in diameter, lying north of Absecon and west of Little Egg Inlet, by which it is connected with the ocean. It has a depth of from 4 to 13 feet. There are no communities on the bay. Mullica River empties into the western end of Great Bay. This river is three-fourths mile wide at its mouth and one-third mile wide 6 miles above. Extensive seed beds are found near its mouth. There are no sources of considerable pollution on either the bay or river.

LITTLE EGG HARBOR.[1]

Little Egg Harbor is located east of Tuckerton and is bounded on the ocean side by Long Beach; it is connected with Great Bay and extends north to Manahawken Bay.

[1] See Table O, (p. 107).

Beach Haven Borough is a summer resort with a normal population of 272. The community has recently installed a sewage-disposal system, the effluent from which is discharged into the ocean. Several restaurants and hotels not connected therewith are said to discharge sewage into the bay. This resort is closed during the winter season.

The only other communities on the bay are Tuckerton and West Creek, the latter being a hamlet without sewerage system.

Tuckerton is a borough with a population (1910) of 1,868, and has a considerable trade in oysters, clams, and fish. Oyster beds are located along the eastern shore of Little Egg Harbor north of Tuckerton Creek, in the thoroughfares connecting Great Bay with Little Egg Harbor, and in the vicinity of Beach Haven.

This area was inspected by the Public Health Service during cold weather, but it is stated that during the summer months 12 or 15 house boats anchor within 500 feet of the beds near Beach Haven. Previous to 1913 oysters were floated in dangerous proximity to the outfalls from Beach Haven hotels, but it is stated that this practice has been stopped by action of the New Jersey State Board of Health.

On an island near the center of the bay is a fish rendering factory, which employs about 75 men from May to November. The nearest oyster beds are about 1 mile from this island. The State board of health found that of 28 samples of water taken in the bay, only 7 per cent, or 2 samples, showed gas in 1 c. c. quantities.

Oysters taken in Little Egg Harbor are removed from the beds to Tuckerton Creek, West Creek, Big Creek, Mullica and Bass Rivers, and there "floated" before they are shipped.

TUCKERTON CREEK.

Tuckerton Creek rises in Cedar Swamps above Tuckerton and is dammed at Tuckerton for the water supply of the town. The stream is tidal for about 2½ miles below the dam. Careful search failed to show any source of pollution other than an occasional house boat. The oyster floats are secured alongside the bank, the uppermost float being about one-half mile below the dam, and they extend for about 1 mile below the town.

The town has no public sewerage system and no private sewers empty into the creek. No privies or other sources of pollution were found near the floats.

Of five samples of water taken from the dam down to the floats, three showed *B. coli* present in 10 c. c., but not in 1 c. c.; and two in 1 c. c. quantities, but not in 0.1 c. c. The oysters were examined 48 hours after they were taken from the water; of ten samples, one scored 32 and two 23, the others all scoring 14 or less. Oysters from

Tuckerton Creek are believed to be safe, so long as the board of health continues its present efficient supervision. There is some potential danger in every creek of this character.

WEST CREEK.

West Creek is similar to Tuckerton Creek and there are no sources of pollution on its banks. One sample of water from a tributary showed *B. coli* present in 0.1 c. c. It drained a field and there was no other apparent source of pollution. Oysters all scored 3 or less; the temperature, however, was nearly 0° C. when they were taken.

BARNEGAT BAY.[1]

Barnegat Bay is a large, shallow body of water extending from Barnegat Inlet 18½ miles northward on the west side of Island Beach to Bayhead and about 4 miles westward to the village of Barnegat; here it connects with shallow estuaries extending southward 15 miles back of Long Beach to Little Egg Inlet. In the bay are numerous islands and flats, and a large number of creeks and small rivers discharge into it from the west.

The principal villages on the bay and its tributaries and their distances from Barnegat Light House are as follows: Waretown, 4 miles; Barnegat, 5 miles; Forked River, 6½ miles; Cedar Creek, 8½ miles; Toms River, 15 miles; Bayhead, 18½ miles.

Until recent years the shellfish industry of this area was an extensive one. Oysters were grown in the numerous thoroughfares and "guts" and were floated in various small streams in the neighborhood. At present the industry is small, and only a few bushels of "shell stock" are shipped daily during the season.

Samples were obtained on December 14, in Barnegat Creek, a small stream near Barnegat, with the following results: One sample scored 3, two scored 2, and two scored 0. So far as could be ascertained there is no pollution in the creek.

During the summer season the clam industry engages the partial or entire time of hundreds of persons in this section.

It is believed that these shellfish as a whole are entirely safe. None of the towns except Beach Haven have sewerage systems, the immediate dilution is very great, and the area of probable pollution small. Unless the shellfish be gathered in the immediate vicinity of local sources of pollution they are quite free from danger.

There is no shellfish industry of consequence above this area until the northern end of the New Jersey coast is reached at Sandy Hook. The conditions in this section have been discussed in connection with Raritan Bay.

---

[1] See Table P (p. 168).

SUMMARY AND CONCLUSIONS.

The oyster industry along the New Jersey Coast is at present declining and is of comparatively little importance. The clam industry is important both economically and from a sanitary point of view, because these shellfish are, for the most part, gathered during the period of greatest danger of infectious pollution. Owing to the fact that the population is enormously augmented during the summer season, the incidence of typhoid fever is then greatest, and it is also the period of increased physiological activity of the shellfish.

The majority of the resort communities have more or less efficient sewage disposal plants, the effluents from which are discharged into large bodies of tidal waters, and the enormous dilution and restricted area of movements of such waters form a very great safeguard.

A thorough enforcement of the present State regulations against the taking of shellfish from the condemned areas around Atlantic City and Wildwood, the closure of flats in the vicinity of sewer outfalls such as those at Ocean City, and the abolition of such obvious dangers as the privies in the Mathis "drinking" ditch at Pleasantville and the Conover privy at Absecon, are very essential but should not be difficult.

Large numbers of clams are gathered by summer visitors for their own consumption, and the use of publicity to educate such persons as to the dangers to be avoided impress us as being important.

The question of the pollution of bathing beaches is an important one along this coast, but no instances of gross pollution of important beaches were noted. The prevention of bathing in the immediate vicinity of outfalls along thoroughfares and inland waters is rather difficult and appears to be a matter for education and local police regulations.

DELAWARE BAY AREAS.

There are extensive and valuable oyster beds on both sides of Delaware Bay from about Bombay Hook down to within a few miles of the mouth of the bay. The upper area from the above point down to near a line from Mahon River eastward across to Ship John Light is very prolific; oysters grow very rapidly and the natural beds of this area are the source of most of the seed oysters used in planting the area below the line, both in Maurice River Cove and on the Delaware side of the bay.[1]

The bay is an expansion of the lower part of Delaware River, the dividing line being from Bombay Hook Point to Cohansey Light House. The entrance to the bay from the ocean, between Cape May on the north and Cape Henlopen on the south, is 10 miles wide; but as shoals extend 6¾ miles south and southwest from Cape May, the deep channel is less than 4 miles in width. The bay is of irregular shape, its greatest dimension in a generally NNW. and SSE. direction being 32 miles; at its northern extremity, between Bombay Hook Point and Cohansey Lighthouse, it is 3¾ miles wide, but just below Egg Island Point it has a width of 24 miles.

Extensive shoals, with depths varying from 4 to 18 feet, occupy a greater part of the bay, but there is a deep and well-marked channel leading to the entrance of Delaware River. From Cape May the eastern shore extends about 13 miles in a general NNE. direction to the mouth of Goshen Creek. Here the shore turns northward and westward and trends in the latter direction for about 7 miles to East Point, on which is situated Maurice River Lighthouse. The bight thus formed and the northern part of the bay in its vicinity is known as Maurice River Cove, into the northeastern part of which, about 1 mile northward of East Point, Maurice River discharges.

DELAWARE RIVER.

SANITARY SURVEY.

Sources of pollution.—The Delaware River rises in the southern part of the State of New York and flows in a general southerly direction for about 250 miles to its junction with Delaware Bay, forming the boundary between the State of Pennsylvania and the States of New York and New Jersey. The city of Trenton, 114 miles above the

[1] See map No. 6.

head of the bay, is the head of navigation, below which point the river is subject to tidal influence. The banks of the river are mostly low and in many places marshes extend some distance back from them. There are numerous large and small communities which contribute pollution directly into the stream, the most important of which are:

TABLE 6.—*Important cities on tidal portion of Delaware River.*[1]

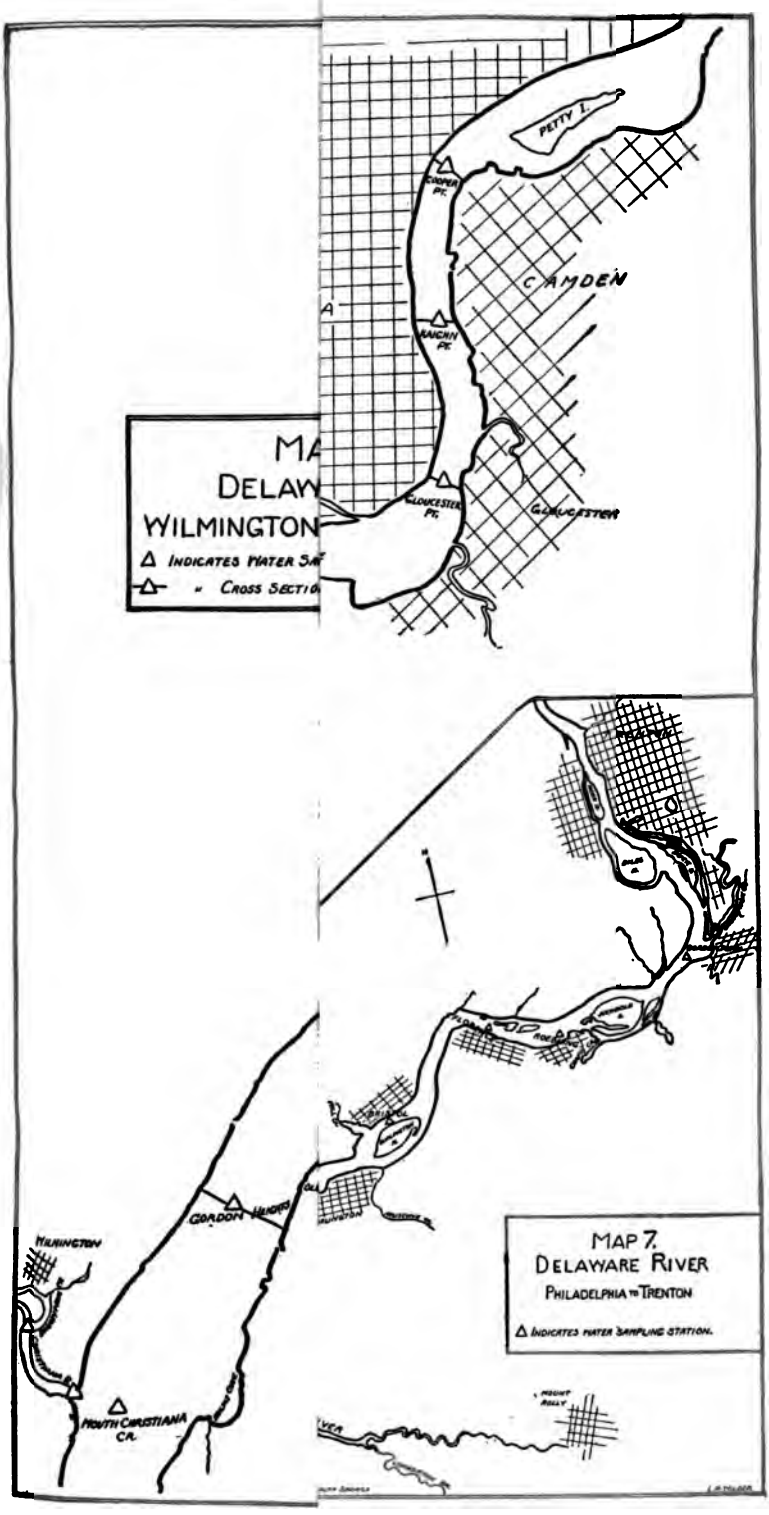
Place.	Distance in miles above head of bay.	Population.
Trenton	82	[2] 109,272
Bordentown	75	4,250
Camden	54	[2] 104,240
Philadelphia	54	[2] 1,683,000
Chester	43	[2] 33,387
Wilmington	32	[2] 87,411
Penns Grove	33	[4] 20,000
New Castle	27	[3] 3,351
Delaware City	23	[3] 1,132
		2,051,993

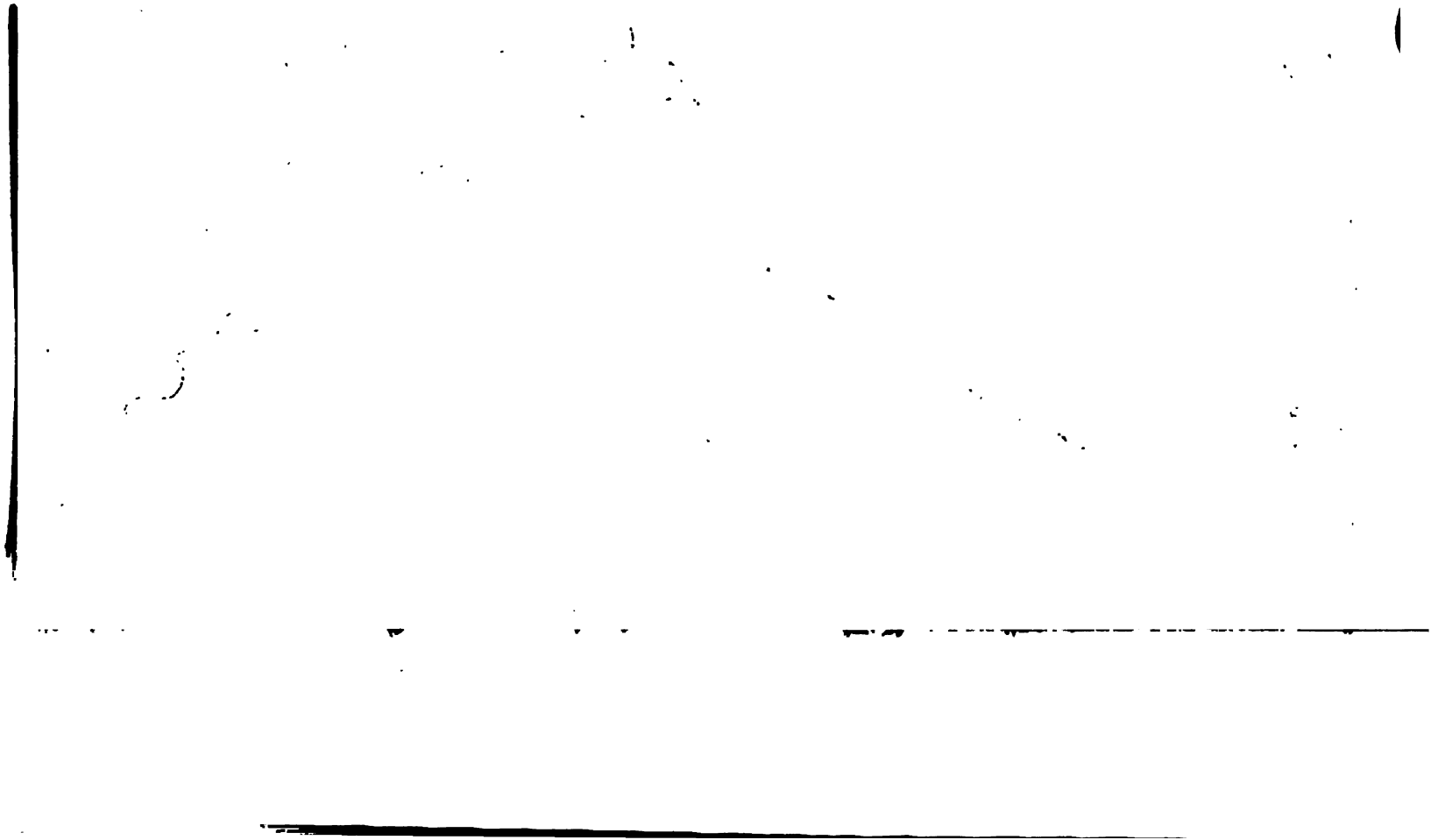
[1] See maps 7, 8, and 9.
[2] Census 1910.
[3] Based on U. S. Census as of 1915.
[4] Estimated.

The banks of the river have many additional sources of industrial and domestic sewage.

The most important tributaries adding pollution to the river are: Lehigh River, which discharges into the Delaware above Trenton after receiving a large amount of mine wastes and sewage from Allentown, Bethlehem, South Bethlehem, Easton, and other communities in Pennsylvania, with a total population of over 100,000, and Phillipsburg, N. J., with a population of about 14,000. The Schuylkill River discharges into the Delaware at Philadelphia after receiving large quantities of mine and other wastes and sewage from the cities of Reading, Pottstown, Phoenixville, Norristown, and other communities above Philadelphia, together with much sewage from Philadelphia. Christiana Creek receives the sewage of Wilmington, situated on its banks, 1 mile from the point at which the creek enters into Delaware River, 32 miles above the head of the bay.

On account of the lack of sufficient time and force, it was impracticable to make a sanitary survey of the tributaries or of the river itself. However, an approximate idea of the amount of domestic sewage contributed to the stream may be estimated from population statistics given above. It should be remembered, moreover, that in addition to these large communities, the watershed in the immediate vicinity of the river contains a large population, both urban and rural. There are few streams in the United States which receive industrial wastes larger in amount and more diverse in character. An intensive


PETTY I.
CAMDEN
GLOUCESTER
WILMINGTON
GORDON HEIGHTS
MAP 7.
DELAWARE RIVER
PHILADELPHIA TO TRENTON
△ INDICATES WATER SAMPLING STATION.



study of the pollution and self-purification of this river should be undertaken in the near future by this Service.

Tides and currents.—It was evident from the writer's experience with other tidal streams that it would be impracticable, with the available force and time, to determine by actual experiment the time factor in the purification of the river between the sources of pollution and the oyster beds. However, an approximate estimate of the average downward gain per day under conditions of normal stream flow may be determined from the data already at hand.

The accompanying table (No. 7) taken from U. S. Coast Pilot, Part V (U. S. Coast and Geodetic Survey), shows the velocities of tidal currents in the river.

TABLE No. 7.—*Velocity of tidal currents in Delaware River.*

	Locality of station.					
	Off New Castle, Del.[1]		Philadelphia, Pa., off Chestnut Street Pier.		Philadelphia, Pa., foot of Petty Island.[2]	
	True direction of current.	Velocity.	True direction of current.	Velocity.	True direction of current.	Velocity.
	Degrees.	*Miles.*	*Degrees.*	*Miles.*	*Degrees.*	*Miles.*
Hours before high water at Philadelphia 2	247	1.79	200	1.4	242	1.76
Hours before high water at Philadelphia 1	235	.68	200	1.3	238	1.66
Hours before high water at Philadelphia 0	29	.94	200	.9	233	1.19
Hours after high water at Philadelphia 1	42	1.68	.....	.0	222	.44
Hours after high water at Philadelphia 2	46	1.91	358	1.1	51	1.12
Hours after high water at Philadelphia 3	48	1.91	358	1.4	48	1.49
Hours before low water at Philadelphia 2	50	.73	358	1.2	51	1.65
Hours before low water at Philadelphia 1	240	1.23	358	1.1	52	1.46
Hours before low water at Philadelphia 0	246	2.20	358	.8	48	.87
Hours after low water at Philadelphia 1	248	2.60	200	.7	234	1.15
Hours after low water at Philadelphia 2	247	2.36	200	1.2	239	1.66
Hours after low water at Philadelphia 3	251	1.58	200	1.4	240	1.78

[1] Observations made in month of August.

[2] Observations made in month of July.

From data contained in the foregoing table and the Atlantic Coast Tide Tables, 1916 (U. S. Coast and Geodetic Survey), the following deductions have been made:

Average net gain downstream a day at Chestnut Street Wharf, Philadelphia:

Average duration of ebb tide, 7.23 hours.
Average velocity of ebb tide, 1.12 miles an hour.
Average of miles traveled on ebb tide, 8.09 or 16.2 miles a day.
Average duration of flood tide, 5.17 hours.
Average velocity of flood tide, 1.15 miles an hour.
Average of miles traveled on flood tide, 5.95 or 11.9 miles a day.
Average net gain downstream a day, 4.3 miles.

Average net gain downstream a day at New Castle, Del.:

Average duration of ebb tide, 6.9 hours.
Average velocity of ebb tide, 1.61 miles an hour.

Average of miles traveled on ebb time, 11.10 or 22.2 miles a day.
Average duration of flood tide, 5.50 hours.
Average velocity of flood tide, 1.66 miles an hour.
Average of miles traveled on flood tide, 9.13 miles an hour, or 18.3 miles a day.
Average net gain downstream a day, 3.9 miles.

The distance between Philadelphia and the upper limits of the market oyster beds is about 60 to 65 miles; therefore, even if we reckon only on constantly suspended particles such as free bacteria probably are, the time interval between Philadelphia and the oyster beds may be estimated roughly at from 12 to 15 days, depending upon stream flow and winds. For substances not in solution or of greater specific gravity than water the time factor is far greater.

From Wilmington, the nearest source of large pollution to the same beds, the distance is about 40 miles. The average down gain a day at New Castle, just below Wilmington, is about 4 miles, and this section would be less subject to the effect of variations due to stream flow. However, as the river gradually becomes wider below Newcastle the net down gain must be much less than the above.

Dilution.—No calculations as to the amount of water in the tidal prism at any point are available, but the quantity of unpolluted ocean water which goes into the lower reaches of the bay and river is enormous.

BACTERIOLOGICAL AND DISSOLVED OXYGEN RESULTS.

For the purpose of determining the extent of pollution in the river and what effect, if any, such pollution might have on the sanitary condition of the water over the areas where oysters are grown in the bay, 211 samples of water were taken on the river for bacteriological examination and 284 dissolved oxygen determinations were made; 134 samples of water and 48 samples of oysters were collected from oyster areas and other points in the bay over a period extending from August to December, 1915, inclusive.[1]

The samples from the river were taken at various stations from Bordentown at the entrance to the D. & R. Canal, 21 miles above Philadelphia, to the junction with the bay at Bombay Hook Point. Eleven of these stations were chosen for cross-section studies, including the dissolved oxygen determinations, the first being at Torresdale and the last at Reedy Island. These points were selected with reference to sources of pollution and were spaced as regularly as this arrangement permitted, with the idea of ascertaining the extent of self-purification going on, the effect of additional pollutions, and the point at which the stream recovers itself.[2]

[1] See Tables Q, R, S, and T, (pp. 109–120).
For location of sampling stations see maps 8, 9, 10.

The results of these studies are shown in detail in Tables Q, R, S, and T, an analysis of which is given in Table U, and the results for the cross sections have, in addition, been plotted on Chart No. 2, for the purpose of showing graphically the extent of pollution and the dissolved oxygen content over the entire area by the cross sections.

From Bordentown down to Torresdale the river seems to have a fairly uniform *B. coli* content, practically all samples being positive in 0.1 c. c. quantities, and there was no serious departure from the normal in free oxygen present.

A slight increase in *B. coli* and decrease in oxygen was noticed from Torresdale to Bridesburg. The latter place is near the entrance of the heavily polluted Frankford Creek and roughly marks the upper limit of the flood tidal effects from the city.

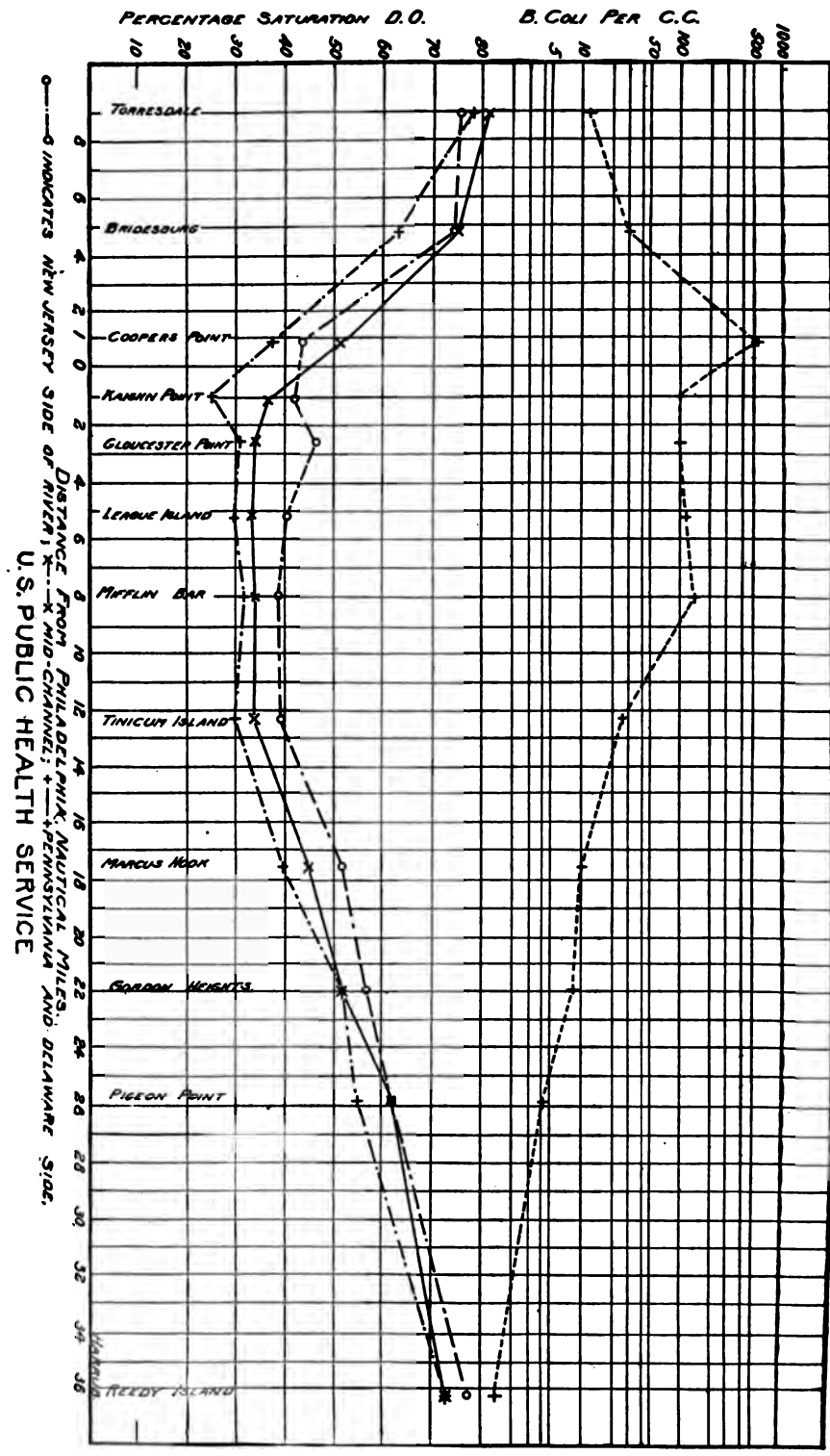
From Bridesburg down to Coopers Point, at the upper end of Camden, and Kaighn Point, at the lower end of Camden (both opposite Philadelphia), there was a sharp rise in *B. coli* content and a corresponding though somewhat lagging decrease in dissolved oxygen content. This whole section is constantly receiving additional pollution from both sides of the river, and just below Philadelphia there is a heavy influx from the Schuylkill River.

This is the last heavy pollution in this section and the *B. coli* content immediately begins a decrease, which continues in a fairly constant ratio to the mouth of the river. The large amount of pollution from Wilmington entering the Delaware at Pigeon Point has little apparent effect upon the *B. coli* or oxygen content of the river, despite the heavy pollution of Christiana River shown by bacteriological examinations and oxygen determinations.

As would be expected, the free-oxygen line on the chart lags considerably and recovery was not begun until Tinicum Island was reached, 7 miles below the entrance of the Schuylkill at League Island.

In general, the *B. coli* content at Torresdale above Philadelphia was again reached at Marcus Hook, about 14 miles below Philaphia, while the percentage of dissolved oxygen present at Torresdale was not recovered until Reedy Island was reached, 40 miles below Philadelphia. Even here the apparent recovery was probably due in part to dilution with sea water, the influence of which is marked at this point.

As shown by Table U, there was a gradual diminution in the bacterial content from Reedy Island, where 37 per cent of the samples gave *B. coli* in 0.1 c. c., 84 per cent in 1 c. c., and 94.7 per cent in 10 c. c. quantities, or a mean of 1.4 *B. coli* per c. c., down to Ship John Light, at the head of the bay, where only 50 per cent of the samples showed *B. coli* present in 10 c. c., and none in smaller quantities of water.


PERCENTAGE SATURATION D.O.
B. COLI PER C.C.
10
20
30
40
50
60
70
80
5
10
50
100
500
1000
TORRESDALE
BRIDESBURG
COOPERS POINT
KAIGHN POINT
GLOUCESTER POINT
LEAGUE ISLAND
MIFFLIN BAR
TINICUM ISLAND
MARCUS HOOK
GORDON HEIGHTS
PIGEON POINT
REEDY ISLAND
DISTANCE FROM PHILADELPHIA, NAUTICAL MILES.
o——o INDICATES NEW JERSEY SIDE OF RIVER; x——x MID-CHANNEL; +——+ PENNSYLVANIA AND DELAWARE SIDE.
U.S. PUBLIC HEALTH SERVICE
CHART NO. 2. DELAWARE RIVER.
RELATION BETWEEN B. COLI COUNT AND DISSOLVED OXYGEN

DELAWARE BAY.

Examination of samples of oysters and water from Delaware Bay showed very little evidence of pollution, even in the upper end, from which oysters are taken for seed purposes only. Of 69 samples of water taken on the New Jersey side below Ship John Light and including Maurice River Cove, 7.2 per cent showed *B. coli* present in 1 c. c. and but 23.2 per cent present in 10 c. c.

On the Delaware side of the bay, of 34 samples, 3 per cent were positive for *B. coli* in 1 c. c. and 15 per cent in 10 c. c.

Of 31 samples of oysters taken in that section of Maurice River Cove near the mouth of the Maurice River, one scored 23 and one 14; in no other instance was the score over 5, and 17, or nearly 55 per cent, gave a score of 0. A study of tidal and weather conditions at the time the two first-mentioned samples were collected indicated that the pollution present apparently came from Maurice River.

Of 17 samples of oysters taken on the Delaware side, in no case was the *B. coli* score over 5. In this connection it should be remembered that this study extended over the period of the year in which the oyster shipping in this district is at its height and during the earlier part of which the danger of infectious pollution was probably at its maximum.

SUMMARY AND CONCLUSIONS.

1. The Delaware River, from Bordentown to Torresdale, is moderately polluted and unsafe for use as a drinking water unless subjected to suitable purification.

2. The river from Bridesburg, just above Philadelphia, down to Mifflin Bar, just below Philadelphia, is grossly polluted, as evidenced by the high bacterial content and deficiency of oxygen.

3. The bacterial content at Marcus Hook, 14 miles below Philadelphia, and the dissolved oxygen present at Reedy Island, 40 miles below that city, are approximately the same as at Torresdale.

4. From Reedy Island down to the junction of the river and bay the self-purification continues, so that at the latter point *B. coli* were found present in only 50 per cent of 10 c. c. samples.

5. Analysis of the results obtained in Delaware Bay shows an absence of serious pollution; the mean average of less than 1 *B. coli* in 50 cubic centimeters of water, with a total bacterial count at 37° of less than 50 colonies per cubic centimeter, indicate a water of considerable purity.

6. It is evident, therefore, that shellfish as taken from the beds of Delaware Bay are safe as an article of food.

MAURICE RIVER.

GENERAL OBSERVATIONS.

In view of the fact that practically all oysters grown in Delaware Bay are carried to the Maurice or Cohansey Rivers and floated in these waters before they are shipped, and because of their subsequent wide interstate distribution, an intensive study of sanitary conditions in these streams was made in cooperation with the State department of health. This investigation covered a sufficiently long period of time to include all seasonal variations.

EXTENT OF OYSTER INDUSTRY.

The oyster industry has grown to considerable size in this part of the State. Bivalve and Maurice River, the two shipping points near the mouth of the Maurice River, are reported to handle about 100 carloads of oysters daily during the busy season. The business carried on at these places amounts to several millions of dollars annually; hence serious pollution of the producing area, resulting necessarily in the condemnation of oysters from these localities, would be a matter of vital concern to these towns and to the State as a whole, while the interstate shipment of the oysters throughout the country make the sanitary conditions of these areas a matter of material importance.

METHOD OF HANDLING OYSTERS.

The oysters are grown in portions of the Delaware Bay in comparatively shallow water, the greater number of beds on the New Jersey side being in Maurice River Cove, which extends from Egg Island Point to Cape May Point. The bottom of the bay here is for the most part mud, although some parts are sandy, with a depth of water ranging from 5 to 30 feet.

Oysters are dredged from these beds, loaded on boats, and brought to the floats located along the banks of the Maurice River, the waters of which are less saline than those over the beds. The floating process consists in placing the oysters in partially submerged open scows, located in such a way that the surface water from the river passes over and around the oysters. Here the oysters, while feeding, take in a certain amount of river water, and expel grit and sand. During this process, as a result of osmosis, the bulk of the oyster is greatly increased and, to the uninitiated, the oyster appears to be

very fat. If the river water in which the oysters are floated is polluted, the floating process necessarily results in contamination of the oysters, and in many cases ultimate rejection on the market. Oysters are usually floated for two tides, or about 24 hours, although this time may be varied on account of various local conditions. During low temperatures, when the oysters are physiologically inactive, the floating is often extended over periods of several days.

Oyster floats are located on both sides of the Maurice River in what is known as the "Long Reach," about 2 miles from the mouth of the stream, and also on the Cohansey River at Greenwich Pier. When the oysters have taken in enough of the fresh river water to sufficiently reduce the salt content, increase their bulk, and rid themselves of grit, they are removed from the floats to scows, brought to the wharves, counted into barrels or sacks, and shipped. During these various handlings the oysters remain tightly closed and the chances of contamination are comparatively slight. In order, however, to reduce this chance to a minimum, considerable care is exercised in securing clean bags and barrels, and even the shipping cars are required to be satisfactorily cleaned before they are used for transportation. Both the State and local authorities are to be commended for their activity in securing good local sanitary conditions.

A very small percentage of the oysters shipped from the Maurice and Cohansey Rivers are shucked, almost the entire product being shipped in the shell, so that the possibility of contamination in the shucking process is almost entirely eliminated at these points.

NATURE OF INVESTIGATION.

From the above brief outline it is seen that the most probable sources of pollution of Maurice Cove oysters would be:

1. Contamination from the waters in which they are grown.
2. Contamination by shipping in dirty containers and cars.
3. Contamination by coming into contact with polluted river water during the floating process.

As has been previously shown, oysters taken from the beds were found to be free from any serious pollution, and the water from Maurice River Cove, over the beds, was also found to be of satisfactory quality.

The possibilities of contamination in shipping are believed to be negligible in view of the care taken to secure clean containers and cars and also because of the fact that the oysters remain closed during handling and shipment. In view of these facts it is evident that any insanitary condition of oysters shipped from these points depends upon the condition of the waters of the river in which they are floated.

SANITARY SURVEY OF MAURICE RIVER WATERSHED.

A preliminary sanitary survey of Maurice River was made in September, 1915, by Sanitary Engineer C. A. Haskins, and this was supplemented in October and November by a more comprehensive study by Sanitary Engineer J. K. Hoskins.

Maurice River, the largest stream in southern New Jersey, rises near Glassboro, in Gloucester County, and flows almost due south, about 33 miles, to Maurice River Cove, a part of Delaware Bay. The entire drainage area, as shown on the accompanying map, No. 10, comprising 405 square miles, is in the flat sandy formation common to southern New Jersey, most of which is sparsely populated, a considerable part being forested. The greater part of the drainage area lies in Cumberland County.

The river is navigable and tidal to Millville, where a large dam divides the stream into two parts, each of which will be considered separately.

I. RIVER ABOVE MILLVILLE.

The drainage area above the head of tide, comprises an area of 226 square miles, a considerable portion of which is forested. The forest drainage imparts a high vegetable color to the water, the turbidity usually remaining low. An earthen dam, 2,200 feet long, located one-half mile above Millville, impounds the river water in a reservoir with an area of 926 acres, forming the largest artificial lake in the State. A fall of 26 feet is made available by this dam, and the resulting power is used for industrial purposes.

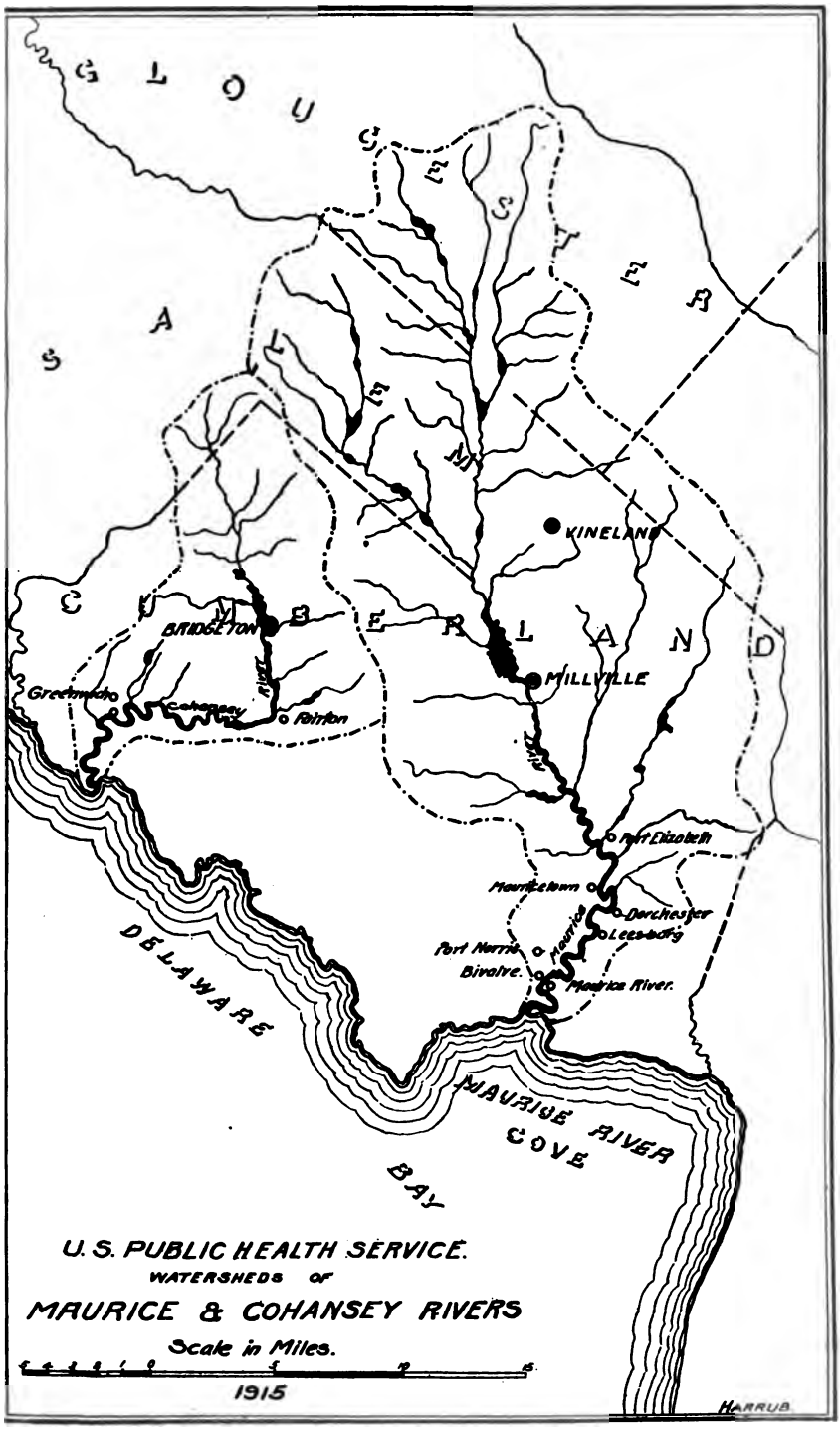
Stream flow.—Few accurate records of stream flow of the Maurice River are available. The report of Geo. W. T. Miller on the Maurice River,[1] states that the average flow at Millville is 35,300 cubic feet per minute. Volume III of the Report of the Geological Survey of New Jersey for 1894 estimates the average flow as lower than this, or about 21,800 cubic feet per minute. The average discharge during the driest year is estimated as 18,600 cubic feet per minute, while the flow during the driest month is given as 3,510 cubic feet per minute.

Population.—The largest town on this part of the watershed is Vineland, having a population in 1910 of 5,282, and in 1915 estimated at 5,760, while the 1915 State census gives about 6,200. The rural population of the watershed is estimated at 58 per square mile, giving a total rural population of about 13,100. The total population on the watershed above Millville is therefore about 19,300, or 85.5 per square mile.

Truck farming is the principal occupation of the rural population and a considerable portion of this area is under intensive cultivation.

[1] Doc. 667, 29th Congress.

MAP NO. 10.


GLOUCESTER
SALEM
CUMBERLAND
KINELAND
BRIDGETON
MILLVILLE
Greenwich
Cohansey
Fairton
Port Elizabeth
Dorchester
Leesburg
Port Norris
Bivalve
Maurice River
DELAWARE
MAURICE RIVER
COVE
BAY
U. S. PUBLIC HEALTH SERVICE.
WATERSHEDS OF
MAURICE & COHANSEY RIVERS
Scale in Miles.
1915
HARRUB.

Sources of pollution.—The principal and practically only direct source of pollution of Maurice River above Millville is the city of Vineland, the domestic and industrial wastes from which are discharged into a small tributary, after being passed through a sewage disposal plant.

A sanitary survey of Vineland showed that practically all streets of the town were sewered. There are 1,549 connections to the city sewers, serving 88.5 per cent of the population, or about 5,500 people. The remainder of the population, in 200 homes, use privies with water-tight receptacles, which are emptied weekly, the contents being hauled to a farm outside of town and plowed under. Strict supervision by the local board of health virtually precludes the possibility of stream pollution from these privies. All trade wastes are passed through the disposal plant and mixed with the domestic sewage.

The sewage disposal plant of Vineland is located at one edge of the town and covers an area of about six acres. The method of treatment of the sewage consists of sedimentation in a series of basins formed by embankment, filtration through underdrained sand beds, and disinfection of the filter effluent by means of hypochlorite of lime solution. The sedimentation beds are inadequate for the purpose of taking care of the quantity of sewage coming to them, and the sand filters are heavily overloaded. The entire plant is in urgent need of enlargement and rearrangement. It is at present necessary to run some of the sewage to improvised settling basins, from which it is discharged direct to the creek, without sand filtration or hypochlorite disinfection. The final effluent is discharged into the Tarkiln branch of the Maurice River.

Analyses of the effluent of the Vineland sewage disposal plant, published in the Annual Reports of the State Board of Health of New Jersey for 1909 to 1912, inclusive, show an average of 300,900 bacteria per cubic centimeter at 20°, and 26,800 bacteria at 37°, with an average count of 5,900 *B. coli* per cubic centimeter. The average total solids is 161 parts per million, and the average relative stability is 40. From these figures it is apparent that considerable improvement in the quality of the effluent is desirable.

In addition to the municipal disposal plant there are two other sewage disposal plants serving institutions at Vineland. The Training School for Feeble-Minded Children disposes of all wastes by sedimentation and broad irrigation on farm land. There is no effluent discharged from this area. The Home for Feeble-Minded Women has a somewhat similar process, and it is believed that little actual pollution of the water course results from this source.

The large lake above Millville and below Vineland probably has a beneficial effect on the river water, due to the storage period afforded, with consequent sedimentation. Analyses of water taken from the

outlet of this reservoir show in many cases evidence of slight pollution, although these analyses have not been extended over a long enough period to warrant definite conclusions as to the safety of the stream at this point.

II. RIVER BELOW MILLVILLE.[1]

Sources of pollution.—The river is tidal the entire distance from Millville to its mouth. From Millville the stream flows southeast, then southwest, to Maurice River Cove, a distance of 24 miles. For the first four miles below Millville, the river flows between wooded bluffs of sand, gravel, and clay, interspersed with rolling farm lands. Two miles above Mauricetown, salt marshes appear on the right bank, the upland receding more and more. On the left bank, the fast land continues to within 2 miles of the mouth, where salt marshes appear. Considerable areas of these lowlands have been banked and are under cultivation, and this work is being extended at the present time.

The channel from French's Bar to Millville has been dredged to a minimum depth of 7 feet. Below French's Bar the controlling depth is over 10 feet at mean low water, while in places it reaches 40 to 50 feet.

At Millville the low-water width is about 100 feet. The river gradually widens until, in the lower reaches, it varies in width from 500 to 1,000 feet.

There are four tributaries of considerable size to the main stream between Millville and Mauricetown. White Marsh Run and Buckshutem Creek drain the area to the west, while Menantico and Manumuskin Creeks drain the wilderness to the east.

The drainage area of the Maurice River between Millville and the mouth of the stream is 179 square miles; it is very sparsely populated, and has no source of direct pollution except Millville. The several small settlements along the banks have no sewers and so discharge no wastes directly into the stream. Some of the land is under cultivation, and this may contribute a small amount of pollution to the main stream. A fish-rendering plant located about 2 miles above Bivalve contributes a considerable amount of organic matter to the pollution.

The most evident and serious pollution of the river is caused by the city of Millville.[2] Millville is a rather busy industrial community employing a considerable amount of labor of a low grade. The enforcement of sanitary regulations has been neglected, and sanitary conditions are therefore not of the best.

---

[1] See Map No. 11.

[2] Population 12,451 in 1910, and an estimated population of 13,437 in 1915.

A sanitary survey of Millville indicated that probably 4,500 of the population are connected to the sanitary sewers; although lack of records makes it difficult to confirm this figure definitely. The remainder of the population depends upon cesspools and privies, many of which are in bad condition.

The sanitary sewers are poorly constructed and admit excessive amounts of ground water, a condition which, along with others, has led to the inefficient operation and practical neglect of the sewage-disposal plant at the lower end of the town.

The disposal plant consists of sedimentation tanks operated in series, an aeration well, contact beds, copper sulphate disinfection, and a tidal storage tank. At the time of the investigation the sedimentation tanks were seriously clogged and the contact beds entirely so. It was stated that copper sulphate was being added, but this has probably little effect on the bacterial content. As a result the river was seriously polluted at this point by the discharge of poorly treated sewage from a population of at least 4,500 people. Raw sewage also is discharged directly into the river from a section of the city too low to drain by gravity to the disposal plant. It is believed the industrial wastes are not important from a bacterial standpoint and add little pollution of this nature.

The various settlements along the river between Millville and Bivalve also must be considered as possible sources contributing pollution to the stream. While none of the sewers in these towns empty directly into the river, they nevertheless drain indirectly to the watercourse. Sanitary regulations are not enforced in these places, and in some cases privies are located close to the banks. In times of heavy washing rains the danger from pollution from these villages may become important. Attention must be paid to this source of pollution to insure a satisfactory quality of the water in Maurice River.

The only other apparent sources of pollution affecting the oyster floats are the towns of Bivalve and Maurice River themselves, and the oyster boats plying the river at these points. The local boards of health have realized the dangers of pollution from these sources and have taken active steps to reduce them to a minimum. A complete system of scavenger service for the boats has been organized, and all excreta on the boats are deposited in cans, which are removed daily by a scavenger, and taken to farm land, all cans being cleaned and disinfected. Several privies still exist back from the shore line, but, it is believed, out of range of probable chances of directly polluting the river. Additional toilet facilities for the accommodation of the laborers employed in handling oysters will no doubt prove a benefit to local sanitary conditions near the oyster floats. Constant atten-

tion to the scavenger system will be necessary to produce effective results from this service at all times.

Tides and currents.—The tides play an important part in the flow of Maurice River from Millville to its mouth, and it is therefore necessary to consider them in connection with the transmission of polluting substances from Millville to the oyster floats at Bivalve. The tides of Maurice River are discussed in the report to Congress of E. A. Gieseler, Assistant Engineer United States Army, in reporting on improvements for that stream, and from this report the following information has been obtained.

High and low water levels both traverse the distance from the mouth of the river to Millville in about the same time, about two and one-half hours; but while the motion of high-water level is accelerated as it passes upstream, low-water level is retarded in about the same proportion. The distance from the mouth to Mauricetown is traversed by the high-water level in one and one-half hours, while from Mauricetown to Millville only one hour is consumed. The low-water level, on the other hand, traverses the same distance in one hour and one and one-half hours, respectively. Changes of current take place at the mouth about one hour, and at Mauricetown about one-half hour, after high and low water. At Millville the flood current changes a little before high-water stand, while ebb current changes about three-fourths hour after low-water stand. Thus, while at the mouth and at Mauricetown the duration of the flood current and ebb current are respectively equal to the duration of rise and duration of fall, at Millville the duration of ebb current is one hour longer than the fall, and that of flood is one hour shorter than the rise. The average rise and fall of the tide is about 6 feet at the mouth and a little over 5 feet at Millville.

The mean tidal prism of the river has been computed at 500,000,000 cubic feet, of which 20,000,000 cubic feet may be fresh water received during flood tide. About the same amount of fresh water being received during ebb tide, the entire discharge in 6 hours and 20 minutes of the ebb at the mouth amounts to about 520,000,000 cubic feet.

The greatest mean velocity of the ebb current at the mouth is reached about 4.3 hours after high water. The discharge at this time, through a cross section of 11,400 square feet, is 29,000 cubic feet per second. The same calculation for Mauricetown gives a much smaller figure, due to the flooded meadows below the village.

Float tests.—In order to determine the time required for sewage to flow from Millville to the oyster floats at Bivalve, a series of float tests was undertaken and carried out jointly by the State department of health, and the United States Public Health Service. It is realized that these experiments gave only approximate results, and

not enough of them were made to determine exactly the time required, but it is believed a reasonably fair idea of the currents can be had from them.

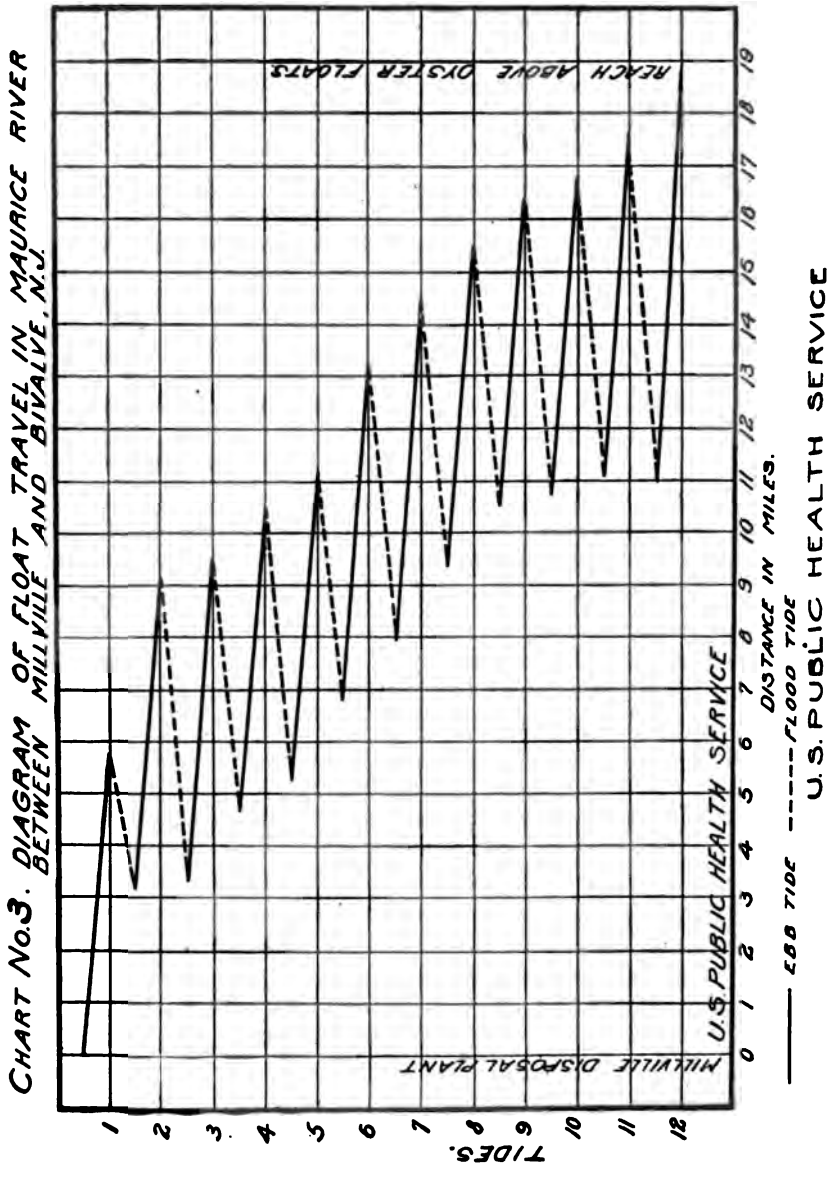
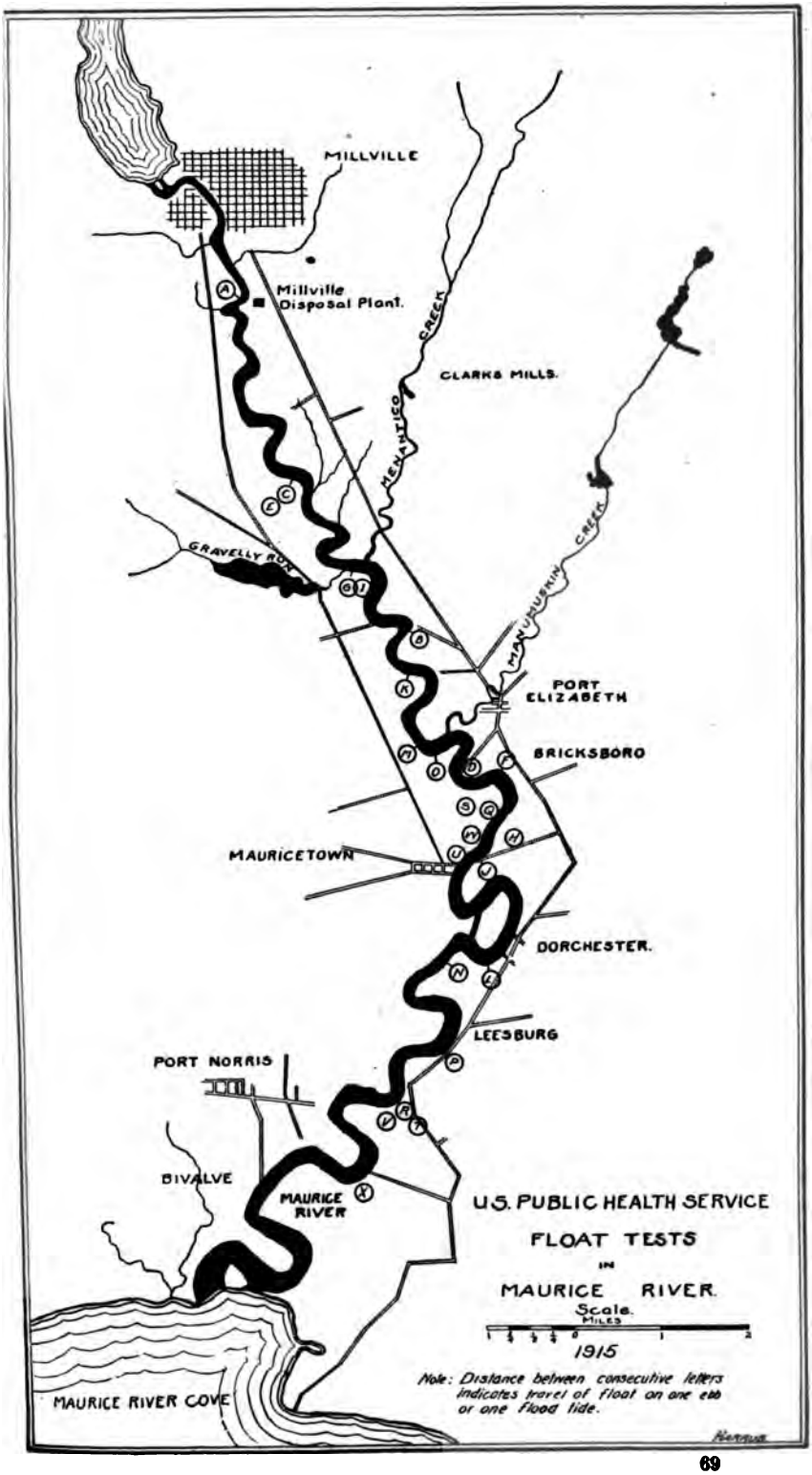


CHART No. 3. DIAGRAM OF FLOAT TRAVEL IN MAURICE RIVER BETWEEN MILLVILLE AND BIVALVE, N.J.
REACH ABOVE OYSTER FLOATS
MILLVILLE DISPOSAL PLANT
U.S. PUBLIC HEALTH SERVICE
TIDES.
DISTANCE IN MILES.
EBB TIDE ----- FLOOD TIDE
U.S. PUBLIC HEALTH SERVICE

It was found that winds greatly influenced the speed and course of the floats, although they were submerged to a depth of 4 feet with a very small area exposed. For this reason, it was decided that more nearly accurate results could be obtained by using the floats only on

MAP NO.11.


MILLVILLE
Millville Disposal Plant.
MENANTICO CREEK
CLARKS MILLS.
MANUMUSKIN CREEK
GRAVELLY RUN
PORT ELIZABETH
BRICKSBORO
MAURICETOWN
DORCHESTER.
LEESBURG
PORT NORRIS
BIVALVE
MAURICE RIVER
MAURICE RIVER COVE
U.S. PUBLIC HEALTH SERVICE
FLOAT TESTS
IN
MAURICE RIVER.
Scale.
MILES
1915
Note: Distance between consecutive letters indicates travel of float on one ebb or one flood tide.

comparatively calm days. The floats were always allowed to run a full tide without interruption, except to keep them in the channel and prevent them from stranding. The accompanying chart shows the time required to float from the disposal plant at Millville to the reach above the oyster beds at Bivalve.

These experiments indicated that sewage from Millville may be expected to reach the oyster beds at Bivalve in six days. Under favorable conditions, this time may be shortened. It is probably safe to say that from 5 to 10 days is required for water from Millville to reach Bivalve and Maurice River.

There is a certain amount of sedimentation taking place during this time, due to the numerous reversals of current and also due to the mixing of the fresh and salt water, with the consequent apparent precipitation of a certain amount of color in the fresh water; the velocity of the stream, however, is such that the benefit derived from sedimentation may be comparatively small. The maximum distance traversed by the floats on one ebb tide was 7½ miles in 5.6 hours, or an average rate of 1.96 feet per second. The highest rate during this time indicated a velocity of about 2.6 feet per second. It is believed that this velocity is high enough to prevent any sedimentation of consequence and probably would have a tendency to stir up considerable finer sediment deposited during slower velocities.

RESULTS OF EXAMINATIONS OF OYSTERS AND WATER.

Three hundred samples of oysters and water were collected in Maurice River for examination. The results of determinations of free oxygen present in water of the river (Table V, p. 122) show a minimum of 63.8 per cent of saturation near the sewer outfall at Millville, with a loss, after 24 hours incubation at 20°, of 0.60 p. p. m.; while near oyster floats at Bivalve it varied from 75 to 87.9 per cent of saturation, with a maximum loss on incubation of 1.35 p. p. m.[1]

It is evident, therefore, that while there is a deficiency in free oxygen, the lower reaches of the river are not seriously overloaded as far as unsatiated organic matter is concerned.[2]

During the investigation there were examined 96 samples of oysters floated at Maurice River and Bivalve, the two shipping points on the river, for varying periods of time; of these some were taken from shipping houses and barges, some from floats, and others were duplicates of samples collected by the party on the *Bratton* in Maurice River Cove and floated in the river for comparison. The results obtained are recorded in detail in Tables V and W, pp. 122–127.

It will be noted that two samples examined October 4, gave scores of 320 each. These were from a few oysters in an unused float out

[1] See also Table W. [2] See Chart 4.

of the water and exposed to the sunshine and the length of time that they had been floated is unknown No other samples taken at any time scored over 41. Of the 96 samples—

2, or 2.10 per cent, scored 320; 5, or 5.20 per cent, scored 41; 6, or 6.25 per cent, scored 32; 8, or 8.30 per cent, scored 23; and 75, or 78.13 per cent, scored 14 or less.

During the same period 89 samples of water were collected in this floating area and examined, of which—

86 or 96.75 per cent showed *B. coli* present in 10 c. c. quantities; 3, or 3.25 per cent, showed *B. coli* absent in 10 c. c.; 21, or 23.59 per cent, showed *B. coli* present in 10 c. c. but not in 1 c. c.; 4, or 4.49 per cent, showed *B. coli* absent in 1 c. c.; 47, or 51.68 per cent, showed *B. coli* present in 1 c. c. but not in 0.1 c. c.; and 15, or 16.85 per cent, showed *B. coli* present in 0.1 c. c.

Or, discarding the four samples, which were negative in 1. c. c. but which were not planted in 10 c. c. quantities—

3, or 3.52 per cent, showed *B. coli* absent in 10 c. c. quantities; 82, or 96.47 per cent, showed *B. coli* present in 10 c. c. quantities; 61, or 71.76 per cent, showed *B. coli* present in 1 c. c. quantities; and 15, or 17.64 per cent, showed *B. coli* present in 0.1 c. c. quantities.

The results obtained from samples taken along the course of the river below the disposal plant at Millville show a gradual decrease in the mean *B. coli* content of the water from 46.5 *B. coli* per c. c. to a mean average of 0.7 *B. coli* per c. c. in the floating area, as is shown in the following table:

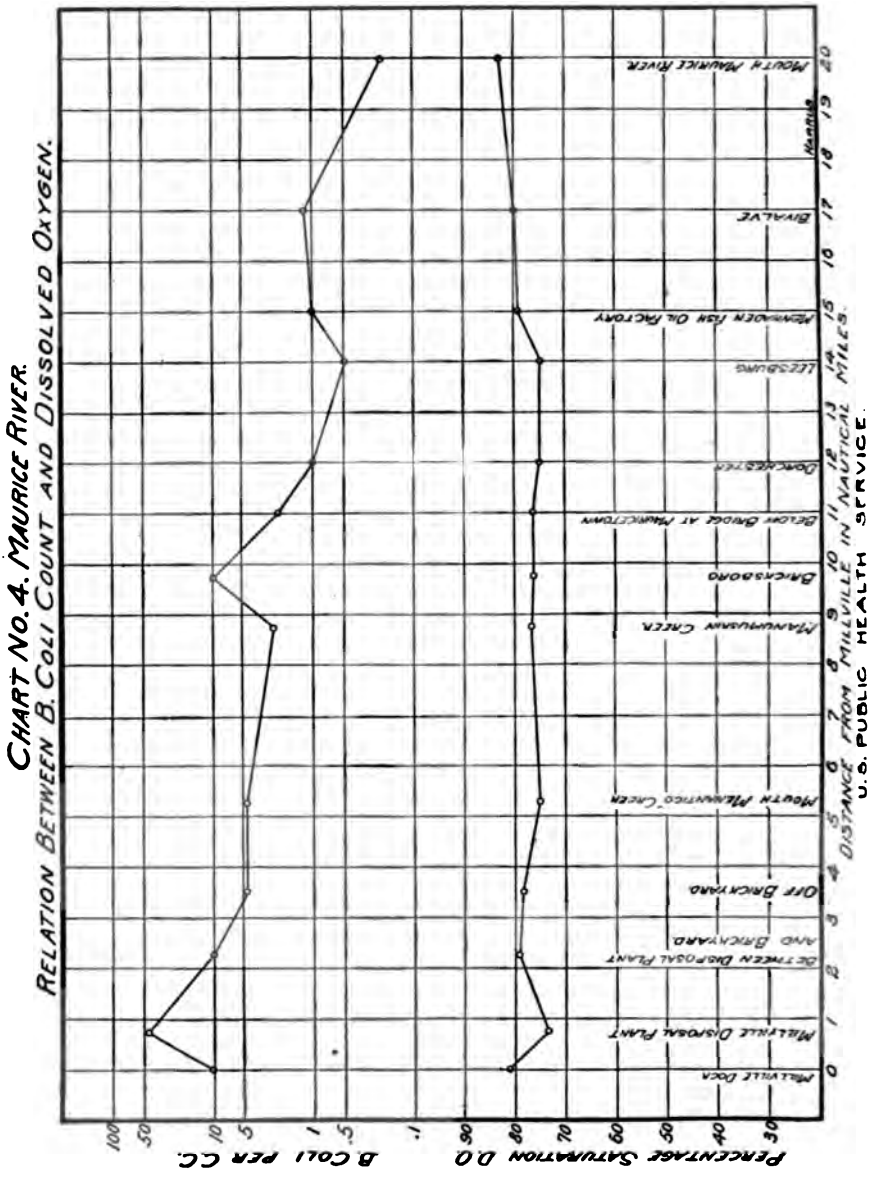
TABLE 8.—*Mean number of B. coli per c. c. of water in Maurice River.*

Station.	Mean number of B. coli.
Millville above sewage disposal plant	10.0
Off outfall of Millville sewage disposal plant	46.5
Midway between Millville sewage disposal plant outfall and brickyard	10.0
Brickyard	3.2
Mouth Manantico Creek	3.2
Mouth Manumuskin Creek	2.7
Mauricetown	2.1
Dorchester	1.0
Leesburg	.3
Fish-rendering factory	.5
Floating area	.7

The samples taken in the various tributaries show the average *B. coli*, in those sections of the streams above the tidal influx from the Maurice River itself, to be lower than the average *B. coli* content of the main river; hence it seems evident that the main pollution is from Millville rather than from any other source. It is probable that after heavy rainfall on the lower watershed the pollution in the river is somewhat augmented by the run-off from fields and other rural sources; but, because of the sparsely settled condition, the sandy soil, and flat terrain of the district, it is not probable that much additional pollution of any kind thus reaches the river.

TYPHOID FEVER ON THE MAURICE RIVER WATERSHED.

A study of the prevalence of typhoid fever on the watershed was made by Assistant Surgeon Waller, based upon statistics secured by the New Jersey Department of Health, inspection of local records,



and personal interviews with physicians in the various localities, as a result of which it was ascertained that Millville, with a population of 12,451 in 1910, had an average of 12.5 cases per annum during the

period 1907 to 1915, the maximum number of cases reported having been 20 in 1913–14, and the minimum 1 in 1909–10.[1]

The greatest danger of infection of the river with typhoid organisms is during the months from August to December, the peak of the typhoid-fever curve being quite constantly in August or September. It is at the beginning of September that the oyster season opens and the floating of oysters is begun. The water in the river at this period is warm, and oysters are physiologically active and feed rapidly.

Commercial Township, Landis Township, and Maurice River Township, with Millville, comprise the whole watershed in the tidal area.

Commercial Township, with a population of 2,604 in 1910, includes the town of Bivalve, the great floating and shipping center; Port Norris, a community about 1 mile from the river near Bivalve; and Mauricetown, on the river about half way between Millville and Bivalve.

There have been only 8 cases of typhoid fever reported from this township within the last eight years, three cases having been reported in September and October 1913–14, respectively. Most of the cases have occurred during those months. Personal interviews with local physicians seemed to confirm the above figures.

Maurice River Township includes the floating and shipping center of that name, opposite Bivalve, and also the small communities, Heislerville and Leesburg. The total population in 1910 was 2,124, and the total number of cases of typhoid reported for the past eight years was 17, of which 5 occurred in June and 4 in February. From September to December there were 5 cases in the eight years.

Landis Township, with a population of 6,435 in 1910, had a total of 15 cases reported in the eight-year period, nearly all of which were between August and December. This township adjoins Millville on the south side of the river and reaches to Maurice River Township.

SUMMARY.

The principal pollution in that portion of Maurice River used for floating oysters is sewage discharged into the stream by the city of Millville. Some of the polluted water probably reaches the oyster floats at Bivalve and Maurice River in from 5 to 10 days, depending upon the rapidity of stream flow and direction and force of prevailing winds. Sedimentation between these points should not be relied upon to eliminate the danger of pollution of oysters.

The various small communities along the river are potential, if not actual, sources of pollution of the stream.

Bacteriological examination of the river water in which oysters are floated shows a considerable amount of pollution, indicated by the

[1] See Appendix II, p. 135 et seq.

constant presence of *B. coli* in amounts of water varying from 0.1 c. c. to 10 c. c., with a mean average of 0.7 *B. coli* per c. c.

Examinations of numbers of samples of oysters when taken from the beds in Maurice River Cove showed little pollution, while the examination of oysters after floating in Maurice River showed constantly some pollution acquired by immersion in the river water; however, with the exception of two samples which had been on a float for an undetermined period, none of these samples taken during any season showed scores sufficiently high to condemn them under the present standards.

A study of the prevalence of typhoid fever in that portion of the watershed adjacent to the communities engaged in floating and shipping oysters showed a very low typhoid rate.

As has been shown, the typhoid-fever incidence at Millville is higher than that in the surrounding country. A study made by the New Jersey Department of Health showed that it was a daily custom of men engaged in the business to open and eat large numbers of oysters to ascertain when they were ready for shipment, and these men also carried quantities of raw oysters to their families. Notwithstanding this there is an absence of typhoid fever among them. The writer's observations confirm this fact.

CONCLUSION AND RECOMMENDATIONS.

Taking into consideration all the factors which may directly or indirectly contribute infectious pollution to Maurice River, it is doubtful if the waters of this stream can be considered, under present conditions, a safe place in which to float oysters.

In view of the above, the method of treating the sewage at Millville should be promptly modified by increasing the efficiency of the present disposal plant and by eliminating the discharge of all raw sewage into the stream, so that the effluent will not be a source of serious pollution.

We have been informed by the New Jersey State Department of Health that a chlorine gas disinfection plant has been ordered and will be installed in the Millville disposal station in the near future. If efficiently operated this should remove the chief source of infectious pollution.

Sanitary privies or cesspools, or other suitable safeguards should be installed in the small communities below Millville. Unrelaxing vigilance should be exercised in enforcing sanitary regulations at Bivalve and Maurice River to prevent local pollution of the stream.

Under such conditions the oysters floated in this river will be safe.

COHANSEY RIVER.

SANITARY SURVEY.

The Cohansey River rises in Salem County and flows for 13 miles nearly due south to Fairton, and thence 8 miles west to Delaware Bay. The drainage area, as shown on map No. 11, page 69, comprises 109 square miles, most of which is flat sandy land, common to southern New Jersey. The river is tidal and navigable to Bridgeton, a distance of 9 miles in a direct line from the mouth and 19 miles following the course of the stream.

The drainage area above Bridgeton is about 48 square miles in extent; it is largely an agricultural region, with no settlements of any considerable size, and no towns have public sewers draining to the water course. The watershed is rather sparsely settled, and most of the pollution is drainage from cultivated farm lands and a few rural communities.

The watershed below Bridgeton, comprising an area of 61 square miles, is largely low flat ground, much of which is not cultivated and some of which is protected from flooding at high tide by artificial banks constructed along both sides of the stream. There are no tributaries of importance below Bridgeton, and no towns having public sewers contributing direct pollution to the stream.

Analyses of the raw water of Cohansey River above Bridgeton made by the State board of health show the presence of *B. coli* rather consistently. During the year 1914, out of a total of 11 samples examined, 8 indicated *B. coli* present in 1 c. c., 1 in 0.1 c. c., and 2 not present in 5 c. c. From this it is evident that, notwithstanding the rather sparsely populated watershed above Bridgeton, considerable pollution reaches the stream. This pollution is rightly considered so serious by the city of Bridgeton that a modern mechanical filtration plant has been installed for the treatment of the public water supply.

The principal source of direct pollution of the upper Cohansey River by domestic sewage is the city of Bridgeton, located on both sides of the stream, 19 miles from its mouth and about 17 miles from the oyster floats at Greenwich Pier.

Bridgeton in 1910 had a population of 14,209 and an estimated population in 1915 of 14,365. The State census of 1915 gives a population of 13,840, showing a loss since the Federal census of 1910. The town is a busy industrial community and the principal market center for a rather extensive farming area in this section of the State.

A sanitary survey of Bridgeton showed that there are recorded 420 connections to the sanitary sewers. A house to house canvass, made in 1909, showed that 598 houses were connected to the sewers, as stated in the report of Mr. Clyde Potts to the city of Bridgeton, under date of December 7, 1909. From this it is evident that not all connections are recorded, and it is therefore difficult to estimate the exact number of inhabitants contributing sewage. A fair estimate as to the number of people using the public sewers would perhaps be 4,000. It is estimated that of the remainder, 21 per cent use cesspools and 50 per cent privies, and these are scattered in all parts of the town. The privies are mostly of the surface type, and some of them overhang small tributary streams. In time of heavy rains this part of the population will contribute serious pollution to the stream, due to the rather rapid drainage of the town to the Cohansey. Frozen ground in the winter months will aggravate this condition.

The sewage from the public sewers is supposed to be treated in two disposal plants, one located on each side of the river, at the downstream edge of the town.

The method for treatment consists of sedimentation in covered tanks, the application of hypochlorite of lime solution to the settled sewage, and secondary sedimentation, followed by discharge into the creek. Owing to the topography of the city, it is necessary to pump some of the sewage from the sewer mains to the sedimentation tanks. At the time of visiting this plant, the pumps were not operating, and as a result, the low level sewage flow was being by-passed around the sedimentation tanks and discharged into the creek without any practical disinfection. At one of the disinfection plants the hypochlorite solution tank was empty and consequently no treatment was being secured.

Two separate visits were made to these plants and both times the operation was found to be deficient. The conclusion formed was that the operation was careless and inefficient; that no uniform treatment was being given the sewage of the city; and that considerable pollution was being contributed because of this neglect.

It was stated locally that various private sewers were discharging domestic sewage directly into the stream. No such sewers were located, although several apparently abandoned private sewers were found.

There is also considerable pollution of the Cohansey by the various industries located at Bridgeton, but there is little, it is believed, that would increase the colon content to any appreciable extent. A number of canning factories discharge large amounts of waste and a dyeing establishment discharges a considerable amount of dye waste, wash waters, and spent bleaching solutions.

The only settlement of any size between Bridgeton and Greenwich is the village of Fairton, about 4 miles below Bridgeton, with a population of about 400. Fairton has no public sewers, the entire population depending on privies, mostly of the surface type.

The nearest source of pollution of the oysters floated in the Cohansey is at Greenwich Pier, where the floats are located. Sanitary conditions here could be considerably improved by a more active local control. While much has been done, there still remain numbers of shacks and boats in the vicinity, which of necessity contribute pollution to the stream. While the number of oyster boats in the Cohansey is comparatively small, the danger from pollution from this source certainly exists and, in the vicinity of the oyster floats, may be at times the cause of gross pollution.

STREAM FLOW.

Little data on stream flow of the Cohansey River is available. The New Jersey State Geological Survey Report for 1894, Vol. III, page 257, estimates the rainfall of an average year as 45.88 inches, of which 19.61 inches is assumed to run-off, giving an average flow at Bridgeton of 46,650,000 gallons per day. The same figures for an ordinary dry year are 36.80 inches rainfall and 40,400,000 gallons per day flow at Bridgeton, while for the driest period the monthly rainfall is given as 0.94 inches, with 0.30 inches flowing off, corresponding to a flow at Bridgeton of 8,400,000 gallons per day.

Since the portion of the river from Bridgeton to the mouth is tidal, it also receives considerable amounts of sea water, which tends to dilute the sewage from Bridgeton. The entire channel acts somewhat as a tidal basin, a large body of water flowing back and forth with the rise and fall of the tide and moving gradually toward the mouth of the stream. Potts, in his report above mentioned, estimates that this basin holds 3,750 million gallons of water, and that 1,500 million gallons of sea water enter the lower reaches every day. Just how much sedimentation is effected in this basin has not been determined, but the same conditions of reversal of current and mingling of land and sea water occur in the Cohansey as in the Maurice River.

In order to study the currents in the stream below Bridgeton, Potts made numerous float experiments from which he determined that one ebb tide would carry a float from Bridgeton a distance of 4¼ miles down stream, and that the following flood tide would return the float to within 800 feet of the original starting point. His deduction from these tests was that the net gain of the water at each ebb tide averages 1,000 feet, and that during the winter months, when the run-off is greatest, the gain may be as much as 2,500 feet per tide. Assuming these figures to be correct, the minimum time

required for sewage from Bridgeton to reach Greenwich Pier, traveling a distance of 17 miles, would be about 13½ days, remembering that the last ebb tide would carry the sewage a distance of 4¼ miles. Various elements, such as height of tide, velocity and direction of wind, and excessive run-off for certain periods, may tend to shorten this time by a considerable amount.

BACTERIOLOGICAL STUDIES.[1]

There were examined 31 samples of water from that portion of the river in which the oyster floats are anchored. Of these—

2, or 6.45 per cent were negative for *B. coli* in 10 c. c. quantities; 7, or 22.58 per cent were positive for *B. coli* in 10 c. c. quantities, but not in 1 c. c.; 15, or 48.38 per cent were positive for *B. coli* in 1 c. c. quantities, but not in 0.1 c. c.; and 7, or 22.58 per cent were positive for *B. coli* in 0.1 c. c. quantities.

Or—

2, or 6.45 per cent were negative for *B. coli* in 10 c. c. quantities; 29, or 93.54 per cent were positive for *B. coli* in 10 c. c. quantities; 22, or 70.96 per cent were positive for B. coli in 1 c. c. quantities; and 7, or 22.58 per cent were positive for *B. coli* in 0.1 c. c. quantities.

The results from samples taken at Bridgeton and various points down the river indicated a gradual decrease in the number of *B. coli*, as shown by the following averages computed from the above data:

TABLE 9.—*Mean number of B. coli per c. c. of water at certain points in Cohansey River.*

Station.	Mean number of B. coli.
Bridgeton	63
Bridgeton, 1 mile below town	56.2
Bridgeton, 3 miles below town	10
Fairton	10
Island below Fairton	4.6
Third reach above Wetherells	4.6
Wetherells	10
Fourth reach above Laning wharf	2.1
Laning wharf	3.2
Area of floats	.7

The oyster business on the Cohansey River, where there are only three shippers is very much smaller than that on the Maurice River. The river is used for floating oysters grown on the Delaware side of Delaware Bay. These oysters are brought to Greenwich Pier, floated in the same manner as at Bivalve and Maurice River, and shipped in the shell by rail.

Of 57 samples of oysters floated at Greenwich Pier, 1 scored 410, 1 scored 320, 2 scored 41, 2 scored 32, 4 scored 23, and 47 scored 14 or less. The two high scores were encountered at different seasons of the year, one in October (temperature of water 16.6°), and one in

[1] See Tables Y and Z, pp. 131-134.

December (temperature of water 0.5°). It is believed that these oysters were polluted by excreta from vessels lying at or near the floats.

For typhoid fever studies see Appendix II, page 135.

SUMMARY.

The source of most of the pollution found in the Cohansey River is the city of Bridgeton. There is also the possibility of pollution, small in amount but dangerous in character, from such communities as Fairton.

So far as may be judged by the study of floats, currents, tides and stream flow, the time factor in purification between Bridgeton and Greenwich Pier is greater than that between Millville and Maurice River and Bivalve on the Maurice River.

While the number of vessels engaged in the industry at Greenwich Pier on the Cohansey is much smaller than the large number at Bivalve and Maurice River, nevertheless there is a constant potential danger of infectious pollution by fresh excreta from the persons on the vessels which lie quite near the floats.

CONCLUSIONS.

In view of these facts it seems fair to conclude that under present conditions the waters of the Cohansey River at Greenwich Pier are not entirely safe for the floating of oysters.

The discharge of all raw sewage into the river at Bridgeton should be stopped either by connection to the sewage disposal plants at Bridgeton or the installation of safe forms of privy disposal.

The use of by-passes at the Bridgeton disposal plants should be discontinued. These plants should have such constant competent supervision as will insure a safe effluent at least throughout the oyster floating season.

Sources of pollution along the river should be eliminated. At Greenwich Pier there should be instituted a system which will remove the danger of pollution from vessels and oyster houses in the vicinity of the floats.

INFECTIOUS DISEASES AND POLLUTION OF COASTAL WATERS.

While the bacteriological examination of the waters and shellfish, together with a sanitary survey of the contributing watershed, furnishes fairly accurate knowledge of the total amount of pollution from human sources, it is quite obvious that in order to obtain data as to the actual danger from the presence of the causative organisms of such diseases, it is necessary to know both the amount of such diseases on the watershed and their relation to the use of the waters in question for bathing purposes and as sources of shellfish. In other words, it is essential to inquire into methods of transmission in order to ascertain whether such use of the coastal waters has given rise to outbreaks of typhoid fever or other intestinal infection.

The typhoid fever statistics of the communities on the various watersheds have been secured from the State Department of Health by Passed Asst. Surg. Frost, under whose direction a sanitary survey of New Jersey was being made, and from other sources. They will be found in Appendix 11, page —.

In addition, Passed Asst. Surg. Draper was specially detailed to visit the communities along the coast adjacent to the water areas under investigation for the purpose of securing any possible additional information as to whether the use of such waters for sewage disposal, bathing, or as sources of sea food had any influence in the transmission of disease.

Health authorities and practicing physicians in the cities and villages on the New Jersey coast were consulted by Dr. Draper in regard to this question and the records of typhoid fever and other intestinal diseases for 10 years past were carefully examined.

With the exception of certain cases of typhoid fever which occurred at Atlantic City in 1902 and certain other cases at Ocean City in 1910, which have been previously fully reported by State and local health authorities, no relationship between the use of the waters for the purposes above mentioned and the occurrence of typhoid fever and other intestinal diseases was found.

Nevertheless, the historic outbreaks at Wesleyan University, Conn., Lawrence and Goshen, N. Y., those at Atlantic City and Ocean City, as well as those of Portsmouth, Plymouth, and Southampton, England, Cette and other places in Europe, very clearly point out the danger from oysters taken in grossly polluted waters.

The outbreak at Atlantic City in 1902, to which allusion has been made, was thoroughly studied by Dr. Edward Guion and Herbert

F. Snow, who showed that the epidemic was due to the eating of oysters floated and clams taken at the mouth of the Penrose Canal.

This canal was shown to have been discharging an unusual amount of sewage, owing to a break in a large sewer, laid in the canal, which carried a considerable amount of the city sewage out into the "Thoroughfare."

Snow found "1,000,000 organisms per c. c. at 37°, of which nine-tenths were intestinal," in the water immediately over the outlet, and "1,150 37° organisms of which 520 per c. c. were of intestinal origin," at a distance of 1,000 feet from the sewer outlet.

Guion wisely concludes "there is a zone of pollution established by the mere fact of the existence of a populated city upon the banks of a stream, or tidal estuary which makes the laying down of oysters and clams in these waters a pernicious custom if persisted in, because it renders these articles of food dangerous at times, and always suspicious."

69263°—17——6

GENERAL SUMMARY AND CONCLUSIONS.

Shellfish growing and shipping constitute one of the most important industries in the State of New Jersey, the annual oyster crop being valued at from $2,000,000 to $4,000,000.[1]

As a result of the laboratory examination and sanitary surveys made by the service, it has been determined that the waters in which these shellfish are grown are, with the exception of the small areas described, free from pollution. However, almost all of the oysters grown in these waters are removed to small creeks or rivers, where the salinity of the water is less, for the purpose of "floating" or "freshening" before shipment.

The sanitary condition of such oysters depends upon the condition of these creeks rather than that of the beds on which they are grown, and some of these "drinking" places have been found to be unsatisfactory.

Throughout the State the New Jersey Department of Health has been found to have been active in attempting to remedy dangerous conditions wherever they exist, and it is believed that this organization as at present constituted will do even more efficient work in the future.

In addition to the great value of the coastal waters of New Jersey in connection with the shellfish industry, these waters are of far greater value because of the number of summer resorts along the whole shore from Sandy Hook to Cape May.

The protection of these waters from pollution and nuisance is therefore of the utmost importance to the State, and because shellfish are shipped from the State throughout the country, and the resorts are visited annually by hundreds of thousands of citizens of other States, the sanitary conditions of the resorts and of the coastal waters is a matter of national moment.

People who go to such resorts are gradually being educated by the various public health agencies as to the possible danger of contracting diseases in insanitary surroundings, and are beginning to consider the healthfulness of a resort as an important factor in determining where they shall spend their vacation. As a result the citizens of the resorts are beginning to realize the monetary value of good sanitary measures, and there seems to be a general appreciation of the necessity for maintaining good sanitary conditions in the communities along the coast.

This is manifested by the increased activity of local as well as State authorities in reporting and investigating the origin of cases of

[1] Report N. J. Dept. of Health, 1910.

phoid fever as well as by the number of sewage-disposal plants and proved water supplies. In some instances, however, while nuisance ong the beaches has been abated, and improved conditions in the mmunities have thus been brought about, no provision has been ade for the proper disinfection of sewage effluents, which in themves constitute a danger.

One source of considerable danger exists nearly everywhere along e inland waterways in the vicinity of communities or cottages with werage systems. Bulstrode and others have called attention to is danger in England. It seems to be a common custom for cotgers, boarders, and "trippers" to dig clams, for pleasure or profit, thout reference to the proximity of sewer outfalls. Indeed, such aces often seem on account of their convenient location to be favorite calities with such people. This problem would appear to be one r local sanitary police regulation, although it is of general interest cause of the fact that these people come from all sections of the untry. The use of large warning posters such as are displayed ar Atlantic City is to be commended.

The shellfish areas of Delaware consist of the beds in Delaware Bay, id, while the shellfish-growing industry is of considerable importance, early all of the shipping goes through the New Jersey towns of Maurice River, Bivalve, and Cohansey River stations.

APPENDIX I.

DETAILED RESULTS OF EXAMINATIONS OF SAMPLES OF OYSTERS AND WATER AND DISSOLVED OXYGEN DETERMINATIONS.

TABLE A.—*Raritan River.*

No.	Location of sampling station.	Date.	Hour	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water.	
											Number colonies per c. c., agar 37° 48 hours.	B. coli.
		1915.			*Ft.*				° *C.*			*C. c.*
1	New Brunswick, 500 feet below highway bridge	Sept. 20	8.30 a. m.	Ebb	12		Fair	Heavy				[1] +0.01
2	New Brunswick, 1 mile below highway bridge	20	10.00	do	12		do	Slight				[1] + .01
3	2 miles below New Brunswick	20	10.20	do	12		do	do				[1] + .01
4	3 miles below No. 1	20	10.30	do	12		do	do				+ .1
5	½ mile above Sayreville	20	10.40	do	18		do	do				[1] + .01
6	½ mile below brickyard at Sayreville	20	10.50	do	13		do	do				+ .1
7	1 mile below brickyard at Sayreville	20	11.00	do	25		do	do				+ .1
8	1½ miles below brickyard at Sayreville	20	11.05	do	13		do	do				+ .1
9	2½ miles below brickyard at Sayreville	20	11.15	do	13		do	do				+1
10	1 mile above railroad bridge at Perth Amboy	20	11.25	do	11		do	do				[1] + .01
11	Under highway bridge at Perth Amboy	20	11.30	do	30		do	do				+ .1
12	Under railroad bridge at Perth Amboy	20	11.35	do	19		do	do				+ .1
13	Perth Amboy, 1 mile below railroad bridge	20	11.40	do	22		do	do				+1
14	1,000 yards above Great Beds Light at junction with Arthur Kill.	20	11.45	do	24		do	do				+1
15	1,000 yards east of Great Beds Light	20	12.00 m.	do	23		do	do				[1] + .1
16	2 miles below New Brunswick	Nov. 15	10.00 a. m.	Flood	12	NW	Cloudy	0	8.9	1.0010	38,000	[1] + .1
17	Brickworks above Sayreville	15	10.30	do	20	NW	do	0	8.3	1.0010	75,000	[1] + .1
18	Brickworks at Sayreville	15	11.00	do	16	NW	do	10	8.6	1.0040	12,500	+ .1
19	Red Light No. 2	15	11.30	do	15	NW	do	25	8.9	1.0150	435	+1
20	Sandy Point	15	12.00 m.	do	39	NW	do	25	9.4	1.0190	395	[1] + .1
21	Do	Dec. 2	1.30 p. m.	do	36	SW	Snow	5	5.0		77	+ .1
22	Red Light No. 2	2	1.45	do	13	SW	do	25	5.0		183	+ .1
23	Brickworks at Sayreville	2	2.10	do	16	SW	do	50	3.9		570	[1] + .01
24	Brickworks above Sayreville	2	2.30	do	14	SW	do	10	3.9		900	[1] + .01
25	2 miles below New Brunswick	2	2.50	do	11	SW	do	0	2.8		2,100	[1] + .001

[1] Highest dilution planted.

TABLE B.—*Arthur Kill and Raritan Bay.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.	Per cent saturation.	Parts per million.		
														At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°*C.*			*C. c.*				
1	Above mouth Rahway River	Aug. 13	1.40 p. m.	Ebb	24	W	Fair	60	25	1.0085	[1] 3,000	[2] +0.1	33.7	2.55	1.95	0.60
2	Below mouth Rahway River	13	1.45	do	24	W	do	60	25.6	1.0085	[1] 1,770	[2] + .1	41.6	3.12	2.15	.97
3	Mouth of Fresh Kills	13	2.05	do	24	W	do	60	25	1.0085	[1] 1,450	[2] + .1	32.8	2.48	1.92	.56
4	Opposite P. & R. R. R. docks	13	2.15	do	24	W	do	50	25	1.0095	[1] 1,000	[2] + .1	41.0	3.10	2.73	.37
5	Red buoy above Tottenville, S. I	13	2.40	do	24	W	do	80	25	1.0110	[1] 350	[2] + .1	54.9	4.15	3.70	.45
6	Opposite Perth Amboy Yacht Club	13	2.50	do	23	W	do	30	25	1.0110	[1] 330	[2] + .1	72.1	5.45	4.15	.30
7	Junction Arthur Kill and Raritan River channels.	13	3.05	do	24	W	do	40	25	1.0115	[1] 320	[2] + .1	52.9	4.00	4.80	+.80
8	Channel, Princess Bay	13	3.30	do	25	W	do	5	25.3	1.0150	[1] 80	+1.0	78.0	5.90	5.37	.53
9	Nun Buoy entrance to Cut-off Channel	13	3.43	do	24	W	do	5	25.6	1.0135	[1] 130	[2] + .1	74.8	5.55	5.33	.22
10	Nun buoy No. 2, off Great Kills	13	4.00	Flood	24	W	do	25	26.1	1.0140	[1] 270	[2] + .1	80.6	6.65	6.65	.00
11	Junction Kill Van Kull and Newark Bay.	14	11.20 a. m.	Ebb	27	SW	do	10	25.6	1.0100	[1] 1,830	[2] + .1	48.6	3.60	3.30	.30
12	Opposite Millíken Iron Works, Elizabethport.	14	11.35	do	24	SW	do	40	25	1.0090	[1] 2,300	[2] + .1	37.4	2.80	2.80	.00
13	Mouth of Elizabeth River	14	11.55	do	18	SW	do	60	25	1.0085	[1] 6,700	[2] + .1	29.0	2.20	2.30	+.10
14	Opposite Graselli	14	12.30 p. m.	do	20	SW	do	60	25	1.0085	[1] 620	[2] + .1	35.7	2.70	2.50	.20
15	Above mouth Rahway River	14	12.45	do	24	SW	do	60	25.6	1.0090	[1] 590	[2] + .1	37.7	2.80	2.80	.00
16	Below mouth Rahway River	14	12.50	do	24	SW	do	60	25	1.0090	[1] 320	[2] + .1	38.7	2.95	2.40	.55
17	Mouth of Fresh Kills	14	1.00	do	24	SW	do	60	25	1.0095	[1] 460	+1.0	42.3	3.20	2.27	.93
18	Opposite P. & R. R. R. docks	14	1.20	do	24	SW	do	60	25	1.0095	[1] 540	[2] + .1	56.9	4.23	3.60	.68
19	Red buoy above Tottenville	14	1.40	do	24	SW	do	60	25	1.0115	[1] 40	+1.0	62.8	4.75	4.80	+.05
20	Opposite Perth Amboy Yacht Club	14	1.50	do	23	SW	do	60	25	1.0125	[1] 60	+1.0	70.1	5.30	5.30	.00
21	Junction Arthur Kill and Raritan River channels.	14	2.05	do	24	SW	do	60	25	1.0130	[1] 60	+1.0	70.0	5.25	5.15	.10
22	Nun Buoy entrance to Cut-off Channel	14	2.50	do	24	SW	do	30	25	1.0095	[1] 70	+1.0	88.7	6.70	4.95	1.75
23	Nun buoy No. 2, off Great Kills	14	3.00	do	24	SW	do	15	24.4	1.0150	[1] 80	+1.0	87.5	6.75	4.90	1.85
24	Opposite mouth joint trunk sewer	16	4.15	do	10	SW	do	25	26.1	1.0090	[1] 15,800	[2] + .001	39.1	2.90	2.15	.75
25	Above mouth Rahway River	16	3.50	do	24	SW	do	20	25.6	1.0090	[1] 1,800	+ .01	35.7	2.65	2.10	.55
26	Below mouth Rahway River	16	3.45	do	24	SW	do	20	26.1	1.0100	[1] 1,470	[2] + .01	33.1	2.45	1.90	.55
27	Mouth of Fresh Kills	16	3.30	do	24	SW	do	10	26.1	1.0110	[1] 930	+1.0	38.4	2.85	2.25	.60
28	Opposite P. & R. R. R. docks	16	3.15	do	24	SW	do	10	25.6	1.0105	[1] 680	+ .1	47.8	3.55	3.15	.40
29	Red buoy above Tottenville	16	2.40	do	24	SW	do	5	24.7	1.0130	[1] 280	+ .1	61.5	4.65	4.30	35
30	Buoy off Tottenville	16	2.30	do	24	SW	do	5	25	1.0145	[1] 160	+1.0	61.5	4.65	4.15	.50

[1] From bottom.

[2] Highest dilution planted.

TABLE B.—*Arthur Kill and Raritan Bay*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.	Per cent saturation.	Parts per million.		
														At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°*C.*			*C. c.*				
31	Off Great Beds Light	16	2.00	Ebb	24	SW	Fair	5	26.6	1.0120	[1] 98	[2] + .1	61.8	4.50	3.85	0.65
32	Junction Kill Van Kull and Newark Bay.	17	10.10 a. m.	Flood	15	NW	do	5	24	1.0120	[1] 4,500	+ .01	45.5	3.50	2.90	.60
33	Junction Kill Van Kull and Newark Bay, west side.	17	10.20	do	15	NW	do	5	24.4	1.0070	[1] 3,800	[2] + .001	42.8	3.30	2.40	.90
34	Mouth of Elizabeth River	17	10.30	do	18	NW	do	5	24.4	1.0090	[1] 3,500	+ .01	39.5	3.05	1.75	1.30
35	Opposite mouth joint trunk sewer	17	10.40	do	10	NW	do	5	24.4	1.0090	[1] 5,600	[2] + .001	40.2	3.10	2.20	.90
36	Opposite Graselli	17	10.50	do	10	NW	do	5	24.4	1.0100	[1] 9,200	[2] + .001	35.0	2.70	2.00	.70
37	Above mouth Rahway River	17	11.05	do	20	NW	do	5	25	1.0100	[1] 2,900	[2] + .001	29.0	2.20	1.85	.35
38	Below mouth Rahway River	17	11.10	do	18	NW	do	5	25	1.0100	[1] 680	[2] + .01	32.4	2.45	2.20	.25
39	Mouth of Fresh Kills	17	11.20	do	16	NW	do	5	25	1.0100	[1] 700	[2] + .01	30.4	2.30	2.15	.15
40	Opposite P. & R. R. R. docks	17	11.40	do	20	NW	do	5	25	1.0100	[1] 370	[2] + .01	46.9	3.55	3.35	.20
41	Red buoy above Tottenville	17	12.05 p. m.	do	25	NW	do	5	24	1.0150	[1] 100	+ .1	61.7	4.75	4.50	.25
42	Opposite Perth Amboy Yacht Club	17	12.15	do	23	NW	do	5	24	1.0150	[1] 140	+ .1	65.5	5.05	4.70	.35
43	Junction Arthur Kill and Raritan River.	17	12.30	do	16	NW	do	5	24	1.0160	[1] 68	[2] + .1	63.5	4.90	4.50	.40
44	Off South Amboy	17	12.40	do	16	NW	do	10	24	1.0120	[1] 180	+ .1	56.4	4.25	4.10	.25
45	Princess Bay, opposite White Dental Factory.	17	1.15	do	25	NW	do	5	23.3	1.0160	[1] 120	+1.0	65.6	5.15	4.90	.25

[1] From bottom.

[2] Highest dilution planted.

TABLE C.—*Arthur Kill and Raritan Bay: Analysis of Table B.*

Name of station.	Distance from Junction Arthur Kill and Newark Bay.	Number of samples.	Percentage of samples showing B. coli present in each dilution.						Mean number of B. coli per c. c.	Total count on agar at 37° C.			Dissolved oxygen determinations.						Number of D. O. samples.
													Per cent saturation.			Loss on incubation			
			C. c. 10.	C. c. 1.0.	C. c. 0.1.	C. c. 0.01.	C. c. 0.001.	C. c. 0.0001.		Average.	High.	Low.	Average.	High.	Low.	Average.	High.	Low.	
	Nautical miles.															p. p. m.	p. p. m.	p. p. m.	
Junction of Kill Van Kull and Newark Bay	0.0	2	100	100	100	50	0	.....	31.6	3,165	4,500	1,830	47.1	48.6	45.5	0.45	0.60	0.30	2
Milliken Iron Works	1.1	2	100	100	100	100	50	.....	316	3,050	3,800	2,300	40.1	42.8	37.4	.45	.90	.00	2
Mouth of Elizabeth River	1.8	2	100	100	100	50	0	.....	31.6	5,100	6,700	3,500	34.3	39.5	29.0	.70	1.30	.10	2
Outlet of joint trunk sewer	2.4	2	100	100	100	100	100	.....	1,000+	10,700	15,800	5,600	39.7	40.2	39.1	.83	.90	.75	2
Graselli	3.6	2	100	100	100	100	50	.....	316	4,910	9,200	620	35.4	35.7	35.0	.45	.70	.20	2
Above mouth of Rahway River	4.75	4	100	100	100	100	50	.....	316	2,075	3,000	590	34.0	37.7	29.0	.38	.60	.00	4
Below mouth of Rahway River	5.1	4	100	100	100	50	.....	.....	31.6	1,060	1,770	320	35.5	41.6	32.4	.58	.97	.25	4
Mouth Fresh Kills	6.25	4	100	100	50	25	.....	.....	5.6	885	1,450	460	36.0	42.3	30.4	.56	.93	.15	4
Opposite P. R. R. docks	7.7	4	100	100	100	25	.....	.....	17.8	648	1,000	370	48.2	56.9	41.0	.40	.63	.20	4
Red buoy above Tottenville	8.75	4	100	100	75	25	.....	.....	10	193	350	40	60.2	62.8	54.9	.25	.45	+.05	4
Buoy off Tottenville	10.8	1	100	100	0	.....	.....	.....	1.+	160	160	160	61.5	61.5	61.5	.50	.50	.50	1
Opposite Perth Amboy Yacht Club	11.75	5	100	100	60	20	.....	.....	6.3	177	330	60	69.2	71.2	65.5	.22	.35	.00	3
Opposite South Amboy	12.75	1	100	100	100	0	.....	.....	10.+	180	180	180	56.4	56.4	56.4	.25	.25	.25	1
Great Beds Light	13.75	1	100	100	100	.....	.....	.....	10.+	98	98	98	61.8	61.8	61.8	.65	.65	.65	1
Junction of Arthur Kill and Raritan River	14.0	3	100	100	67	.....	.....	.....	46.8	149	320	60	62.1	70.0	52.9	.10	.40	+.80	3
Princess Bay	16.75	2	100	100	0	.....	.....	.....	1 +	100	120	80	71.8	78.0	65.6	.39	.53	.25	2
Nun Buoy entrance to Cut-off channel	18.6	2	100	100	50	.....	.....	.....	3.2	100	130	70	81.8	83.7	74.8	.98	1.75	.22	2
Nun Buoy No. 2, off Great Kills	21.25	2	100	100	50	.....	.....	.....	3.2	175	270	80	88.6	89.6	87.5	.98	1.85	.00	2

TABLE B.—*Arthur Kill and Raritan Bay*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.	Per cent saturation.	Parts per million.		
														At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°*C.*			*C. c.*				
31	Off Great Beds Light	16	2.00	Ebb..	24	SW...	Fair.....	5	26.6	1.0120	[1] 98	[2] + .1	61.8	4.50	3.85	0.65
32	Junction Kill Van Kull and Newark Bay.	17	10.10 a. m.	Flood.	15	NW...	...do.....	5	24	1.0120	[1] 4,500	+ .01	45.5	3.50	2.90	.60
33	Junction Kill Van Kull and Newark Bay, west side.	17	10.20	...do...	15	NW...	...do.....	5	24.4	1.0070	[1] 3,800	[2] + .001	42.8	3.30	2.40	.90
34	Mouth of Elizabeth River	17	10.30	...do...	18	NW...	...do.....	5	24.4	1.0090	[1] 3,500	+ .01	39.5	3.05	1.75	1.30
35	Opposite mouth joint trunk sewer	17	10.40	...do...	10	NW...	...do.....	5	24.4	1.0090	[1] 5,600	[2] + .001	40.2	3.10	2.20	.90
36	Opposite Graselli	17	10.50	...do...	10	NW...	...do.....	5	24.4	1.0100	[1] 9,200	[2] + .001	35.0	2.70	2.00	.70
37	Above mouth Rahway River	17	11.05	...do...	20	NW...	...do.....	5	25	1.0100	[1] 2,900	[2] + .001	29.0	2.20	1.85	.35
38	Below mouth Rahway River	17	11.10	...do...	18	NW...	...do.....	5	25	1.0100	[1] 680	[2] + .01	32.4	2.45	2.20	.26
39	Mouth of Fresh Kills	17	11.20	...do...	16	NW...	...do.....	5	25	1.0100	[1] 700	[2] + .01	30.4	2.30	2.15	.15
40	Opposite P. & R. R. R. docks	17	11.40	...do...	20	NW...	...do.....	5	25	1.0100	[1] 370	[2] + .01	46.9	3.55	3.35	.20
41	Red buoy above Tottenville	17	12.05 p. m.	...do...	25	NW...	...do.....	5	24	1.0150	[1] 100	+ .1	61.7	4.75	4.50	.25
42	Opposite Perth Amboy Yacht Club	17	12.15	...do...	23	NW...	...do.....	5	24	1.0150	[1] 140	+ .1	65.5	5.05	4.70	.35
43	Junction Arthur Kill and Raritan River.	17	12.30	...do...	16	NW...	...do.....	5	24	1.0160	[1] 68	[2] + .1	63.5	4.90	4.50	.40
44	Off South Amboy	17	12.40	...do...	16	NW...	...do.....	10	24	1.0120	[1] 180	+ .1	56.4	4.35	4.10	.25
45	Princess Bay, opposite White Dental Factory.	17	1.15	...do...	25	NW...	...do.....	5	23.3	1.0160	[1] 120	+1.0	65.6	5.15	4.90	.25

[1] From bottom.

[2] Highest dilution planted.

TABLE C.—*Arthur Kill and Raritan Bay: Analysis of Table B.*

Name of station.	Distance from Junction Arthur Kill and Newark Bay.	Number of samples.	Percentage of samples showing B. coli present in each dilution.						Mean number of B. coli per c. c.	Total count on agar at 37° C.			Dissolved oxygen determinations.						Number of D. O. samples.
													Per cent saturation.			Loss on incubation			
			C. c. 10.	C. c. 1.0.	C. c. 0.1.	C. c. 0.01.	C. c. 0.001.	C. c. 0.0001.		Average.	High.	Low.	Average.	High.	Low.	Average.	High.	Low.	
	Nautical miles.															p. p. m.	p. p. m.	p. p. m.	
Junction of Kill Van Kull and Newark Bay	0.0	2	100	100	100	50	0	.....	31.6	3,165	4,500	1,830	47.1	48.6	45.5	0.45	0.60	0.30	2
Milliken Iron Works	1.1	2	100	100	100	100	50	.....	316	3,050	3,800	2,300	40.1	42.8	37.4	.45	.90	.00	2
Mouth of Elizabeth River	1.8	2	100	100	100	50	0	.....	31.6	5,100	6,700	3,500	34.3	39.5	29.0	.70	1.30	.10	2
Outlet of joint trunk sewer	2.4	2	100	100	100	100	100	.....	1,000+	10,700	15,800	5,600	39.7	40.2	39.1	.83	.90	.75	2
Graselli	3.6	2	100	100	100	100	50	.....	316	4,910	9,200	620	35.4	35.7	35.0	.45	.70	.20	2
Above mouth of Rahway River	4.75	4	100	100	100	100	50	.....	316	2,075	3,000	590	34.0	37.7	29.0	.38	.60	.00	4
Below mouth of Rahway River	5.1	4	100	100	100	50	.....	.....	31.6	1,060	1,770	320	35.5	41.6	32.4	.58	.97	.25	4
Mouth Fresh Kills	6.25	4	100	100	50	25	.....	.....	5.6	885	1,450	460	36.0	42.3	30.4	.56	.93	.15	4
Opposite P. R. R. docks	7.7	4	100	100	100	25	.....	.....	17.8	648	1,000	370	48.2	56.9	41.0	.40	.63	.20	4
Red buoy above Tottenville	8.75	4	100	100	75	25	.....	.....	10	193	350	40	60.2	62.8	54.9	.25	.45	+.05	4
Buoy off Tottenville	10.8	1	100	100	0	.....	.....	.....	1.+	160	160	160	61.5	61.5	61.5	.50	.50	.50	1
Opposite Perth Amboy Yacht Club	11.75	5	100	100	60	20	.....	.....	6.3	177	330	60	69.2	71.2	65.5	.22	.35	.00	3
Opposite South Amboy	12.75	1	100	100	100	0	.....	.....	10.+	180	180	180	56.4	56.4	56.4	.25	.25	.25	1
Great Beds Light	13.75	1	100	100	100	.....	.....	.....	10.+	98	98	98	61.8	61.8	61.8	.65	.65	.65	1
Junction of Arthur Kill and Raritan River	14.0	3	100	100	67	.....	.....	.....	46.8	149	320	60	62.1	70.0	52.9	.10	.40	+.80	3
Princess Bay	16.75	2	100	100	0	.....	.....	.....	1 +	100	120	80	71.8	78.0	65.6	.39	.53	.25	2
Nun Buoy entrance to Cut-off channel	18.6	2	100	100	50	.....	.....	.....	3.2	100	130	70	81.8	88.7	74.8	.98	1.75	.22	2
Nun Buoy No. 2, off Great Kills	21.25	2	100	100	50	.....	.....	.....	3.2	175	270	80	88.6	89.6	87.5	.93	1.85	.00	2

TABLE D.—*New York side of Raritan Bay and Lower New York Bay.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c.c., agar 37°, 48 hours.	B. coli.	Number of colonies per c.c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C.c.*		
46	Bed No. 363	June 28	11.15 a.m.	Ebb	8	SW	Clear	Slight	21.6	1.0195	14	−10	2,900	32
47	Bed No. 870	28	11.25	...do	9	SW	...do	...do	22.2	1.0195	38	+1	2,200	41
48	Bed No. 667	28	11.30	...do	9	SW	...do	...do	21.6	1.0195	24	+1	1,010	41
49	Bed No. 165	28	11.40	...do	9	SW	...do	...do	21.6	1.0200	9	−10	2,000	50
50	Bed No. 427	28	11.50	...do	12	SW	...do	...do	21.1	1.0195	16	+10	1,080	50
51	Bed No. 365	28	11.55	...do	12	SW	...do	...do	21.6	1.0190	12	−10	260	14
52	Bed No. 943	28	12.00 m.	...do	12	SW	...do	...do	22.2	1.0190	20	−10	540	5
53	Bed No. 916	28	12.15 p.m.	...do	14	SW	...do	...do	21.6	1.0190	10	−10	760	50
54	Bed No. 915	28	12.25	...do	14	SW	...do	...do	21.6	1.0190	21	+10	860	32
55	Bed No. 918	28	12.35	...do	13	SW	...do	...do	21.6	1.0190	16	+10	440	5
56	Bed No. 958	28	12.45	...do	15	SW	...do	...do	22.2	1.0200	12	+1	690	5
57	Bed No. 967	28	12.50	...do	14	SW	...do	...do	22.2	1.0190	10	+10	740	32
58	Bed No. 981	29	10.15 a.m.	...do	22	SW	...do	...do	19.4	1.0195	300	+1	220	32
59	Bed No. 861	29	10.25	...do	22	SW	...do	...do	20	1.0195	68	+1	130	5
60	Bed No. 975	29	10.35	...do	22	SW	...do	...do	20	1.0195	420	+1	170	23
61	Bed No. 1006	29	11.05	...do	22	SW	...do	...do	20	1.0195	380	+1	70	32
62	Bed No. 785	29	11.15	...do	22	SW	...do	...do	20	1.0195	195	+1	60	4
63	Bed No. 930	29	12.20 p.m.	...do	16	SW	...do	...do	22.2	1.0190	26	+10	90	2
64	Bed No. 132	July 1	8.45 a.m.	Flood	14	NW	Cloudy	...do	21.6	1.0200	12	+10	200	0
65	Bed No. 194	1	8.55	...do	12	NW	...do	...do	21.6	1.0200	28	+10	800	14
66	Bed No. 622	1	9.00	...do	14	NW	...do	...do	21.6	1.0195	27	−10	800	14
67	1,000 yards W.S.W. from bath house at St. Elizabeth Mission.	1	9.15	...do	16	NW	...do	...do	21.6	1.0190	18	+1	3,000	14
68	Bed No. 549	1	9.50	...do	15	NW	...do	...do	22.2	1.0190	17	+10	400	4
69	Bed No. 787	1	10.00	...do	14	NW	...do	...do	22.2	1.0190	15	+1	800	14
70	Bed No. 270	1	10.10	...do	18	NW	...do	...do	22.2	1.0190	18	−10	100	23
71	Bed No. 831	1	10.20	...do	14	NW	...do	...do	21.1	1.0190	23	+10	100	5
72	Bed No. 307	1	10.50	F.last	20	NW	...do	...do	21.6	1.0190	6	+10	100	3
73	Bed No. 369	1	11.00	...do	18	NW	...do	...do	22.2	1.0190	8	+10	500	4
74	Bed No. 997	1	12.10 p.m.	H.W.	24	NW	Fair	...do	21.1	1.0200	10	+10	200	32
75	Bed No. 999	1	12.30	E.beg.	24	NW	...do	...do	20.5	1.0250	21	+1	1,000	32
76	Bed No. 991	1	1.00	Ebb	24	SW	...do	...do	20.5	1.0200	108	[1]+.1	300	14
77	Bed No. 165	21	11.45 a.m.	Flood	14	None	Cloudy	5	22.7	1.0165	50	+1	400	140
78	Bed No. 968	21	11.55	...do	14	...do	...do	5	23.3	1.0165	21	+1	1,200	32
79	Bed No. 915	21	12.05 p.m.	...do	14	...do	...do	5	23.3	1.0165	62	+1	400	220
80	Bed No. 930	21	12.15	...do	18	...do	...do	5	23.3	1.0165	160	+1	1,200	32

81	Bed No. 861	21	12.25	...do...	18	...do...	...do...	5	23.3	1.0165	92	+ 1	600	32
82	Bed No. 981	21	12.40	...do...	18	...do...	...do...	5	23.3	1.0165	380	[1] + .1	300	230
83	Bed No. 975	21	12.45	...do...	18	...do...	...do...	5	22.7	1.0165	480	[1] + .1	400	41
84	Bed No. 1006	21	12.50	...do...	22	...do...	...do...	5	22.7	1.0165	120	[1] + .1	400	140
85	Bed No. 785	21	1.00	...do...	18	...do...	...do...	5	22.7	1.0165	155	[1] + .1	700	50
86	Bed No. 132	26	10.20 a.m.	Ebb...	14	SE....	Fair....	5	22.7	1.0155	9	+10	600	3
87	Bed No. 234	26	11.15	...do...	14	SE....	...do....	5	23.3	1.0150	7	+10	300	2
88	Bed near No. 831	26	11.25	...do...	16	SE....	...do....	5	23.3	1.0145	18	+ 1	200	0
89	Bed No. 643	26	11.30	...do...	11	SE....	...do....	5	22.7	1.0150	16	+ 1	400	2
90	Bed No. 932	26	11.35	...do...	16	SE....	...do....	5	23.3	1.0145	8	+ 1	400	1
91	Bed No. 215	26	11.50	...do...	12	SE....	...do....	5	23.3	1.0150	12	+ 1	400	2
92	Bed No. 233	26	12.00 p.m.	...do...	11	SE....	...do....	5	23.3	1.0150	10	+10	200	3
93	Bed No. 130	26	12.10	...do...	12	SE....	...do....	5	23.3	1.0150	14	+ 1	300	2
94	Bed No. 307	26	12.26	...do...	18	SE....	...do....	5	23.9	1.0160	20	+ 1	200	1
95	Bed No. 148	27	11.15 a.m.	...do...	15	SE....	...do....	0	23.3	1.0165	9	+10	100	3
96	Bed No. 254	27	11.25	...do...	15	SE....	...do....	0	23.9	1.0165	7	+10	700	2
97	Bed No. 997	27	11.50	...do...	24	SE....	...do....	0	23.9	1.0165	10	+ 1	600	32
98	Bed No. 999	27	12.20 p.m.	...do...	24	SE....	...do....	0	23.9	1.0170	14	−10	400	230
99	Bed No. 991	27	12.30	...do...	24	SE....	...do....	0	24.5	1.0170	8	+10	500	41
100	Bed No. 918	27	1.10	...do...	12	SE....	...do....	0	24.5	1.0165	8	+10	300	1
101	Bed No. 427	27	1.20	...do...	12	SE....	...do....	0	23.9	1.0165	16	+10	200	3
102	Bed No. 369	27	1.25	...do...	15	SE....	...do....	0	24.5	1.0160	20	+ 1	400	0
103	Bed No. 997	Aug. 5	10.55 a.m.	...do...	22	ESE....	...do.[1]...	5	22.7	1.0155	700	+ .1	60,000	14
104	Bed No. 999	5	11.10	...do...	22	ESE....	...do.[1]...	5	22.2	1.0135	[2] 490	[3] + .1	55,000	14
105	Bed No. 991	5	11.25	...do...	22	ESE....	...do.[1]...	5	22.7	1.0135	1,620 (5)	[3] + .1 [3] + .1	41,000	32
106	Bed No. 975	5	11.35	...do...	22	ESE....	...do.[1]...	100	22.7	1.0120	35	+ 1	31,000	4
107	About ½ mile offshore near Elm Tree Beacon.	7	11.00	...do...	22	SW....	...do.[1]...	5	21.6	1.0150	280	[3] + .1	1,000	41
108	Bearings: Old Orchard Light, 184° 33′ 45″; Triangle, Great Kills, 258° 09′ 45″.	7	11.07	...do...	20	SW....	...do.[1]...	5	21.6	1.0150	530	[3] + .1	200	41
109	Old Orchard Light, 209° 52′ 30″; Great Kills Beacon, 263° 13′ 30″.	7	11.50	...do...	20	SW....	...do.[1]...	100	21.6	1.0150	780	[3] + .1	1,100	230
110	Great Kills Beacon, 268° 56′ 15″; Triangle, Great Kills, 300° 35′ 15″.	7	11.55	...do...	24	SW....	...do.[1]...	100	22.2	1.0135	410	[3] + .1	5,100	50
111	100 yards east of buoy No. 2 of Great Kills.	7	12.00 m.	...do...	18	SW....	...do.[1]...	100	23.3	1.0080	620	[3] + .1	1,000	14
112	White Dental Works, 263° 18′ 45″; Great Kills Beacon, 290° 47′ 15″.	7	12.15	...do...	18	SW....	...do.[1]...	100	23.9	1.0080	430	[3] + .1	.....	.....
113	Branch building, St. Elizabeth Mission, 311° 07′ 30″; Princess Bay Light, 348° 42′ 30″	10	10.05 a.m.	...do...	12	N.....	...do....	15	22.7	1.0125	166	[3] + .1	400	2
114	St. Elizabeth Mission, 274° 33′ 45″; Princess Bay Light, 306° 19′ 45″.	10	10.15	...do...	15	NW....	...do....	15	23.3	1.0135	137	+ 1	700	3

[1] Following stormy weather.

[2] From bottom.

[3] Highest dilution planted.

TABLE D.—*New York side of Raritan Bay and Lower New York Bay*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°C.			C. c.		
115	Princess Bay Light, 339° 15′ 0″; White Dental Works, 15° 54′ 30″.	Aug. 10	10.45 a.m.	Ebb...	15	NW...	Fair....	15.....	23.3	1.0140	192	[1]+ .1	500	5
116	Princess Bay Light, 313° 56′ 15″; White Dental Works, 357° 01′ 15″.	10	10.50	...do...	14	NW...	...do....	15.....	23.3	1.0130	126	+ 1	200	5
117	White Dental Works, 347° 41′ 15″; Schwab Sanitorium, 37° 27′ 45″.	10	11.00	...do...	14	NW...	...do....	15.....	23.3	1.0140	103	+ 1	300	3
118	Schwab Sanitorium, 356° 07′ 30″; Observation Tower, 56° 00′ 30″.	10	11.15	...do...	15	NW...	...do....	15.....	22.7	1.0150	220	[1]+ .1	200	32
119	West Bank Light, 77° 41′ 15″; Old Orchard Light, 110° 37′ 00″.	10	11.30	...do...	15	NW...	...do....	10.....	22.7	1.0150	222	+ 1	400	2
120	Keansburg standpipe, 178° 56′ 15″; Keyport standpipe, 208° 26′ 15″.	10	11.50	...do...	15	NW...	...do....	10.....	22.7	1.0150	160	[1]+ .1	500	23
121	St. Elizabeth Mission, 266° 07′ 30″; Schwab Sanitorium, 314° 07′ 30″.	10	12.00 m.	...do...	9	NW...	...do....	10.....	23.3	1.0145	157	+ 1	300	3
122	Near Old Orchard Light.....	Nov. 22	1.00 p.m.	E. last.	25	W....	Cloudy..	20.....	7.2	1.0220	15	+10	425	4
123	Bed No. 891.....	22	1.15	...do...	25	W....	...do....	20.....	6.6	1.0210	24	+ 1	345	1
124	Bed No. 977.....	22	1.25	...do...	20	NNW.	...do....	20.....	6.6	1.0210	22	+10	170	1
125	Bed No. 986.....	22	1.40	...do...	20	NNW.	...do....	20.....	7.6	1.0215	22	+ 1	540	3
126	Bed No. 1015 (north end).....	22	2.12	...do...	22	NNW.	...do....	20.....	7.2	1.0210	34	+10	415	4
127	Bed No. 1015 (south end).....	22	2.22	L. W..	20	NNW.	...do....	20.....	7.2	1.0210	32	+ 1	300	2
128	Bed No. 999.....	22	2.45	F. beg.	20	NNW.	Fair.....	20.....	7.2	1.0210	22	+10	150	3
129	Bed No. 989.....	22	3.20	Flood.	22	NNW.	...do....	20.....	7.7	1.0210	21	+ 1	.....	.....
130	Ellsworth bed, inside mouth Great Kills	23	11.00 a.m.	Ebb..	6	SW...	Cloudy..	0.....	6.1	1.0220	12	+10	325	4
131	Bed No. 919.....	23	11.20	...do...	12	SW...	...do....	5.....	6.1	1.0220	15	+10	320	3
132	Bed No. 899.....	23	11.30	...do...	12	SW...	...do....	5.....	6.1	1.0210	.....	.....	170	3
133	Bed No. 256.....	23	12.00 m.	...do...	10	SW...	...do....	0.....	6.1	1.0210	20	+10	170	1
134	Bed No. 256 (near west end).....	23	12.15 p.m.	...do...	10	SW...	...do....	0.....	6.1	1.0210	25	+10	210	3

[1] Highest dilution planted.

TABLE E.—*Raritan Bay and Lower New York Bay.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water samples.	
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.
		1915.			*Feet.*				°*C.*			*C. c.*
135	Arthur Kill, off Perth Amboy	July 13	10.20 a. m.	Ebb	22	WSW	Fair	Slight	22.7	1.0160	23	+ 1
136	do	13	10.50	do	22	WSW	do	do	23.3	1.0160	37	[1]+ .1
137	Junction Arthur Kill and Raritan River	13	11.15	do	24	WSW	do	do	23.3	1.0155	38	+ 1
138	Red nun buoy No. 8, east of Great Beds Light	13	12.30 p. m.	do	23	WSW	do	do	23.3	1.0160	17	[1]+ .1
139	White spar, east of buoy No. 8	13	1.00	do	23	WSW	do	do	23.3	1.0165	17	[1]+ .1
140	½ mile north of Boundary Beacon	13	1.30	do	14	None	do	do	22.2	1.0165	19	+ 1
141	Eastern edge of oyster grounds off Conaskonk Point	13	2.30	do	12	do	do	do	24	1.0160	7	+ 1
142	Western edge of oyster grounds off Conaskonk Point	13	2.45	do	10	do	do	do	25	1.0160	12	+ 1
143	Between Boundary Beacon and western edge of oyster grounds off Conaskonk Point	13	2.50	E. last	11	do	do	do	24	1.0160	11	+10
144	½ mile off Staten Island shore, oppostie Princess Bay Light	13	3.05	do	11	SE	do	do	24	1.0160	12	+ 1
145	1,000 yards off Great Kills	13	3.45	L. W	10	SE	do	do	23.3	1.0160	3	+ 1
146	100 yards off Staten Island shore, at White Dental Works, near black can buoy No. 3	13	4.00	do	30	SE	do	do	23.3	1.0160	16	+ 1
147	Wharf, White Dental Works	22	2.30	Flood	32	E	Cloudy	do	22.7	1.0170	48	[1]+ .1
148	300 yards off shore, opposite Dental Works	22	2.35	do	27	E	do	do	22.2	1.0165	27	+ 1
149	Halfway between St. Elizabeth Mission and red nun buoy No. 8	22	2.40	do	21	E	do	do	22.7	1.0160	4	+10
150	At red nun buoy No. 8	22	2.45	do	21	E	do	do	22.7	1.0160	26	[1]+ .1
151	Halfway between nun buoy No. 8 and St. Elizabeth Mission	22	2.50	do	21	E	do	do	22.2	1.0160	21	+ 1
152	Channel, opposite St. Elizabeth Mission	22	2.55	do	21	E	do	do	22.2	1.0170	21	+ 1
153	Channel, opposite Princess Bay Light	22	3.00	do	21	E	do	do	22.2	1.0170	13	+ 1
154	Black can buoy No. 5	22	3.05	do	26	E	do	do	22.2	1.0170	31	+10
155	Between sample Nos. 154 and 156	22	3.10	do	24	E	do	do	22.2	1.0170	16	+ 1
156	Black can buoy No. 3	22	3.15	do	24	E	do	do	22.2	1.0170	22	+10
157	¼ mile east of buoy No. 3	22	3.20	do	24	E	do	do	22.2	1.0170	23	+10
158	Black spar east of buoy No. 3	22	3.25	do	24	E	do	do	22.2	1.0170	63	[1]+ .1
159	Red spar No. 4–A	22	3.30	do	24	E	do	do	21.6	1.0170	38	[1]+ .1
160	200 yards shoreward from black and white nun buoy at end of channel	22	3.35	do	22	E	do	do	21.6	1.0170	62	+ 1
161	½ mile northeast of sample No. 160	22	3.40	do	21	E	do	do	21.1	1.0165	150	+ 1
162	Outer edge of oyster grounds, 1½ miles off Great Kills	22	3.45	do	18	E	do	do	21.1	1.0165	78	[1]+ .1
163	½ mile northeast of No. 162	22	3.50	do	18	E	do	do	20.5	1.0165	280	+ 1

[1] Highest dilution planted.

[2] Following stormy weather.

TABLE E.—*Raritan Bay and Lower New York Bay*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water samples.	
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.
		1915.			*Feet.*				°*C.*			*C. c.*
164	Red spar and can off Great Kills	22	4.00 p.m.	Flood	19	E	Cloudy	Slight	20.5	1.0170	310	[1]+ .1
165	½ mile northeast of No. 164	22	4.05	do	19	E	do	do	20.5	1.0170	300	[1]+ .1
166	½ mile northeast of No. 165	22	4.10	do	19	E	do	do	20.5	1.0170	4	[1]+ .1
167	100 yards north of Old Orchard Light	Aug. 5	11.35	E. last	19	ESE	Fair [2]	100	22.7	1.0120	37	+ 1
168	100 yards south of Old Orchard Light	5	11.00	Ebb	20	ESE	do	5	22.7	1.0150	1,200	[1]+ .1
169	do	5	11.20	do	20	ESE	do	100	22.7	1.0120	55	[1]+ .1
170	100 yards north of Old Orchard Light	5	11.10	do	19	ESE	do	5	22.7	1.0135	1,185	[1]+ .1
171	Outlet Keyport sewage disposal plant	June 25	11.15 a. m.	L. W.	1	None	Fair	Slight			150	[1]− .1
172	do	25	11.15	do	1	do	do	do			50	[1]− .1
173	do	26	9.20	Ebb	2	do	Cloudy	Moderate			90	+ 1
174	do	28	6.30 p. m.	Flood	2	SW	Fair	Slight	23	1.0145	435	+10
175	do	29	6.35	do	2	SW	do	do	22.2	1.0170	160	+ 1
176	do	30	9.35 a. m.	do	2	SW	do	do	21.6	1.0175	30	
177	do	July 10	10.35	Ebb	2	S	do	Moderate	21.6	1.0060	72	+ 1
178	The Narrows, opposite Fort Wadsworth	Nov. 26	8.50	Flood	96	None	Foggy	5	6.6		75	− .01
179	Off South Beach	26	9.10	do	14	do	do	5	6.6		30	− .1
180	Off Midland Beach	26	9.30	do	16	do	do	5	6.6		50	+ .1
181	Off Elm Tree Beacon	26	9.45	do	17	do	do	5	6.6		105	+ 1
182	Two miles WSW. of Old Orchard Light	26	10.10	do	28	do	do	5	6.6		11	− 1
183	Keyport Harbor, opposite Keyport Yacht Club	26	2.50 p. m.	Ebb	10	do	Fair	10	7.2		88	+ .1
184	Keyport Channel, opposite Conaskonk Point	26	3.00	do	10	do	do	10	7.2		14	− 1
185	Channel, between Nos. 184 and 186	26	3.10	do	12	do	do	10	7.2		20	− 1
186	Black can buoy No. 3, Keyport Channel	26	3.20	do	12	do	do	5	7.2		10	+ .1
187	Between Old Orchard Light and Great Kills	26	3.35	do	17	do	do	0	7.2		45	− .1
188	Off Elm Tree Beacon	26	3.45	do	18	do	do	0	7.2		30	+ .1
189	Off Midland Beach	26	3.55	do	17	do	do	0	7.2		70	+ .1
190	Off South Beach	26	4.00	do	15	do	do	0	7.2		130	+ .1
191	The Narrows, opposite Fort Wadsworth	26	4.20	do	96	do	do	10	7.2		140	+ .1

[1] Highest dilution planted.

TABLE F.—*Samples of mud, Raritan Bay*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Mud samples.	
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.
		1915.			*Feet.*				°C.			*C. c.*
192	Off Conaskonk Point, northwest corner of oyster planting area.	July 14	1.55 p. m.	Ebb.....	14	None....	Fair.....				16,000	—0.1
193	Off Conaskonk Point, 500 yards shoreward from No. 192.	14	2.05	...do.....	10	...do.....	...do.....				22,500	— .1
194	Off Conaskonk Point, 500 yards shoreward from No. 193	14	2.10	...do.....	8	...do.....	...do.....				1,500	— .1
195	Off Conaskonk Point, 500 yards west of the point....	14	4.55	...do.....	8	...do.....	...do.....				10,900	— .1
196	Off Conaskonk Point, 500 yards northeast of No. 195.	14	5.05	...do.....	8	...do.....	...do.....				1,700	— .1
197	Off Conaskonk Point, eastern end of oyster planting area.	14	5.15	...do.....	12	...do.....	...do.....				5,800	— .1
198	Off Conaskonk Point, 500 yards east of No. 192.....	14	5.20	...do.....	14	...do.....	...do.....				6,100	— .1
199	Off Conaskonk Point, center of oyster planting area.	14	5.30	...do.....	10	...do.....	...do.....				32,500	— .1

TABLE G.—*Raritan Bay, Conaskonk Point (Keyport Bar).*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c. agar 37°, 48 hours.	Score based on B. coli. in shell liquor.
		1915			*Feet.*				°*C.*			*C. c.*		
200	Bed No. 43	June 24	9.00 a. m.	Ebb..	8	NW...	Fair[1]...	Slight.....	18.9	1.0170	[2]5	+10	100	0
201	Bed No. 4, Marylands	24	9.05	...do..	5	NW...	...do[1]...	.....do.....	18.9	1.0175	[2]21	+ 1	300	3
202	Bed No. 4, Rappahannocks	24	9.07	...do..	5	NW...	...do[1]...	.....do.....	18.9	1.0175	[2]14	−10	250	4
203	Bed No. 14	24	9.15	...do..	8	NW...	...do[1]...	.....do.....	19.4	1.0170	[2]14	−10	200	4
204	Bed No. 12	24	9.20	...do..	8	NW...	...do[1]...	.....do.....	19.4	1.0180	[2]13	+ 1	900	3
205	Bed No. 1	24	9.30	...do..	9	NW...	...do[1]...	.....do.....	19.4	1.0175	[2]14	+10	100	4
206	Bed No. 37	24	9.35	...do..	9	NW...	...do[1]...	.....do.....	20	1.0181	[2]11	+ 1	200	2
207	Bed No. 37	24	9.40	...do..	9	NW...	...do[1]...	.....do.....	20	1.0175	.....	.....	100	5
208	Bed No. 37, shore side	24	9.45	...do..	5	NW...	...do[1]...	.....do.....	20	1.0175	.....	.....	150	5
209	Bed No. 27	24	9.55	...do..	9	NW...	...do[1]...	.....do.....	20	1.0170	.....	.....	400	5
210	Bed No. 17, Delawares	24	10.00	...do..	10	NW...	...do[1]...	.....do.....	20	1.0175	.....	.....	100	1
211	Bed No. 4, duplicate floated	24	10.05	...do..	11	NW...	...do[1]...	.....do.....	20	1.0180	.....	.....	100	2
212	Bed No. 5	25	9.25	...do..	12	None...	...do....	.....do.....	21.6	1.0175	8	+ 1	100	1
213	Bed No. 48, East Rivers	25	9.35	...do..	15	...do...	...do....	.....do.....	22.2	1.0175	8	−10	200	0
214	Bed No. 48, Delawares	25	9.50	...do..	15½	...do...	...do....	.....do.....	22.2	1.0180	5	−10	300	0
215	Bed No. 38	25	10.00	...do..	14	...do...	...do....	.....do.....	22.7	1.0175	7	+10	200	1
216	Bed No. 32	25	10.15	...do..	14	...do...	...do....	.....do.....	22.7	1.0170	8	−10	200	1
217	Bed No. 9	25	10.20	...do..	13	...do...	...do....	.....do.....	22.7	1.0170	9	−10	200	1
218	Bed No. 33	25	10.25	...do..	12	...do...	...do....	.....do.....	22.2	1.0170	9	+10	300	1
219	Bed No. 17, North Rivers	25	10.30	...do..	10½	...do...	...do....	.....do.....	22.7	1.0170	9	+10	700	1
220	Bed No. 43	July 19	2.00 p. m.	E. Beg.	11	SW....	...do....	15.....	24.5	1.0150	25	+10	400	2
221	Bed No. 4	19	2.05	...do..	11	SW....	...do....	15.....	24.5	1.0155	20	+10	300	1
222	Bed No. 52	19	2.10	...do..	11	SW....	...do....	15.....	24.5	1.0155	16	+10	500	1
223	Bed No. 19	19	2.30	...do..	12	SW....	...do....	15.....	24.5	1.0150	13	+10	500	1
224	Bed No. 12	19	2.35	...do..	12	SW....	...do....	15.....	24.5	1.0150	68	+10	800	1
225	Bed No. 1	19	2.40	...do..	12	SW....	...do....	15.....	24.5	1.0150	15	+10	600	0
226	Bed No. 37	19	2.45	...do..	12	SW....	...do....	15.....	24.5	1.0150	.....	.....	700	0
227	Bed No. 17	19	2.55	...do..	12	SW....	...do....	15.....	24.5	1.0150	20	+10	300	0
228	Bed No. 33	19	3.10	...do..	13	SW....	...do....	15.....	24.5	1.0155	20	+10	300	2
229	Bed No. 5	19	3.15	...do..	14	SW....	...do....	15.....	25	1.0155	16	+10	300	2
230	Bed No. 48	20	9.25 a. m.	Flood.	14	NNW...	...do....	10.....	22.7	1.0160	9	+10	500	3
231	Bed No. 38	20	9.35	...do..	15	NNW...	...do....	10.....	22.7	1.0160	12	+ 1	200	3
232	Bed No. 3	20	9.55	...do..	13	NNW...	...do....	10.....	22.7	1.0160	8	+ 1	300	1
233	Bed No. 32	20	10.00	...do..	14	NNW...	...do....	10.....	22.7	1.0160	12	+10	300	5
234	Bed No. 6	20	10.20	...do..	12	NNW...	...do....	10.....	22.7	1.0160	12	+10	100	0
235	Bed No. 14	20	10.35	...do..	12	NNW...	...do....	10.....	22.7	1.0160	4	+10	200	2

236	Bed No. 28		20	11.00	...do..	13	NNW.	...do....	10	23.7	1.0160	13	+10	500	2
237	Bed No. 48	Aug.	2	9.15	...do..	17	E.	...do....	5	26	1.0135	190	+ 1	35,000	14
238	Bed No. 32		2	9.45	...do..	16	E.	...do....	5	26.5	1.0120	340	[3] + .1	5,500	2
239	Bed No. 33		2	10.05	...do..	12	E.	...do....	5	27	1.0120	150	[3] + .1	8,300	5
240	Bed No. 6		2	10.20	...do..	12	E.	...do....	5	27	1.0120	340	[3] + .1	5,700	23
241	Bed No. 37		2	10.25	...do..	10	E.	...do....	5	27	1.0120	190	+ 1	4,000	5
242	Bed No. 1		2	10.30	...do..	10	E.	...do....	5	26.5	1.0120	190	[3] + .1	7,000	41
243	Bed No. 12		2	10.40	...do..	10	E.	...do....	5	27	1.0120	350	+ 1	1,600	14
244	Bed No. 14		2	10.45	...do..	9	E.	...do....	5	27	1.0110	290	[3] + .1	2,000	14
246	Bed No. 5		2	10.50	...do..	12	E.	...do....	5	27	1.0100	350	[3] + .1	1,400	14
247	Bed No. 31		2	11.00	...do..	13	W.	...do....	5	27	1.0100	210	[3] + .1	900	23
248	Bed No. 17		5	1.45 p. m.	F.Beg.	10	ESE.	...do[1]...	100	24	1.0065	160	[3] + .1	21,000	50
									100			[2] 248	[3] + .1		
249	Bed No. 5		5	1.55	...do..	14	ESE.	...do[1]...	100	24	1.0065	325	[3] + .1	11,500	41
									100			[2] 287	[3] + .1		
250	Bed No. 31		5	2.15 p. m.	Flood.	12	ESE.	...do.[1]...	100	23.3	1.0060	390 [2] 270	[3] + .1	8,500	41
251	Bed No. 4		5	2.30	...do..	11	ESE.	...do[1]....	100	24	1.0060	390 [2] 300	[3] + .1	6,600	41
252	Bed No. 43		5	2.40	...do..	8	ESE.	...do[1]....	100	24	1.0060	390	[3] + .1	8,800	50
253	Bed No. 25		5	2.50	...do..	12	ESE.	...do[1]....	100	24	1.0060	300 [2] 450	[3] + .1	11,400	41
254	Bed No. 12		5	2.55	...do..	8	ESE.	...do[1]....	100	24	1.0060	450	[3] + .1	5,200	41
255	Bed No. 14		5	3.00	...do..	8	ESE.	...do[1]....	100	24	1.0060	450	[3] + .1	5,700	41
256	Conaskonk Point, sample of 300 brought in and deposited in Lupatcong Creek for observation.		6											500	14
257	....do		6											400	23
258	L. Mason's bed, duplicate floated in Lupatcong Creek.		18											800	23
259	Bed No. 37	Nov.	17	8.35 a. m.	Ebb..	6	NW...	Cloudy[4].	5	5.5	1.0200	[2] 17	+ 1	200	5
260	Bed No. 1		17	9.05	...do..	6	NW.	...do[4]....	5	6.1	1.0200	[2] 18	+ 1	50	0
261	Bed No. 12		17	9.15	...do..	6	NW.	...do[4]....	5	6.1	1.0190	[2] 20	[3] + .1	60	2
262	Bed No. 14		17	9.20	...do..	6	NW.	...do[4]....	5	6.6	1.0190			100	4
263	Bed No. 7		18	10.20	...do..	11	None..	Fair.....	5	6.6	1.0200	[2] 11	+10	1,400	5
264	Bed No. 16		18	10.30	...do..	8	...do..	...do.....	5	6.6	1.0200	[2] 10	+10	3,750	2
265	Bed No. 33		18	10.40	...do..	8	...do..	...do.....	5	7.2	1.0195	[2] 11	+ 1	275	2
266	Bed No. 48		18	11.15	...do..	14	...do..	...do.....	5	7.2	1.0190	[2] 14	+10	5,100	2
267	Bed No. 27		18	11.30	...do..	4	...do..	...do.....	5	7.7	1.0190	[2] 12	+10	380	4
268	Bed No. 28		18	11.50	...do..	4	...do..	...do.....	5	7.7	1.0190	[2] 12	+ 1	3,800	3
269	Bed No. 1, outer edge		18	12.05 p. m.	...do..	10	...do..	...do.....	5	7.7	1.0190	[2] 21	+10	5,200	14
270	Bed No. 23		18	12.10	...do..	8	...do..	...do.....	5	7.7	1.0190	[2] 19	+ 1	1,350	1
271	Bed No. 31		18	12.20	Low water.	14	...do..	...do.....	5	7.7	1.0190	[2] 14	−10	550	1
272	Bed No. 32		23	2.30	Ebb...	14	SW...	Cloudy..	5	6.1	1.0185	16	+ 1	110	0
273	Bed No. 33		23	2.40	...do..	10	SW.	...do.....	5	6.1	1.0185	9	+ 1	60	2
274	Bed No. 27		23	2.40	...do..	10	SW.	...do.....	5	6.1	1.0185	22	+ 1	350	1
275	Bed No. 37		23	3.00	...do..	6	SW.	...do.....	5	6.1	1.0185	23	+ 1	370	1
276	Bed No. 1		23	3.10	...do..	7	SW...	Fair.....	5	6.1	1.0180	18	+ 1	380	1

[1] Following stormy weather. [2] From bottom. [3] Highest dilution planted. [4] Following heavy wind.

TABLE G.—*Raritan Bay, Conaskonk Point (Keyport Bar)*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°C.			C. c.		
277	Bed No. 14	Nov. 23	3.15 p.m.	Ebb	6	SW	Fair	5	6.1	1.0185	27	+10	350	2
278	Bed No. 31	23	3.25	do	7	SW	do	5	6.1	1.0180	17	+ 1	.....	.....
279	Bed No. 4	23	3.30	do	7	SW	do	5	6.1	1.0180	16	+ 1	180	5
280	Bed No. 43	23	3.30	do	7	SW	do	5	6.1	1.0180	.....	.....	160	3
		1916.												
281	Hammer's bed	June 9	11.00 a. m.	do	(1)	NE	Cloudy	.....	.....	.....	.....	+ 1	.....	5
282	do	9	11.00	do	(1)	NE	.....	.....	.....	.....	.....	+ 1	.....	4
283	Maurer's bed	9	11.00	do	(1)	NE	Cloudy	.....	.....	.....	.....	+ 1	.....	3
284	do	9	11.00	do	(1)	NE	.....	.....	.....	.....	.....	− 1	.....	5
285	Wylie's bed	9	11.00	do	(1)	NE	.....	.....	.....	.....	.....	− 1	.....	14
286	do	9	11.00	do	(1)	NE	.....	.....	.....	.....	.....	+ 1	.....	22
287	do	15	6.00 p.m.	Flood	.....	NE	Clear	.....	.....	.....	.....	.....	.....	1

[1] Surface.

TABLE H.—*Matawan Creek.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water samples.	
											Number colonies per c. c., agar 37° 48 hours.	B. coli.
		1915.			*Feet.*				°*C.*			*C. c.*
288	Mouth	June 25	11.20 a. m.	Low water.	3	None	Fair	Slight			110	+ 1
289	....do	26	9.15	Ebb	5	...do	Cloudy[1]	Moderate			220	[2] + .1
290	Above highway bridge at Matawan	Nov. 26	1.45 p. m.	...do	2	...do	Fair	50	5		30	− .1
291	Below highway bridge at Matawan	26	1.50	...do	2	...do	...do	50	5		35	− .1
292	Below fertilizer factory	26	1.55	...do	2	...do	...do	50	5		50	+ 1
293	Below trolley bridge	26	2.05	...do	5	...do	...do	40	5		35	+ 1
294	Mouth	26	2.15	...do	5	...do	...do	40	5		70	+ 1

[1] Following rain.

[2] Highest dilution planted.

TABLE I.—*Lupatcong Creek.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c. 7 agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°C.			C. c.		
54	Below highway bridge, duplicate sample from bed No. 4, Conaskonk Point, floated one low tide.	June 25	11:30 a. m.	L. w...	1	None..	Fair.....	Slight.....	.....	.....	.....	.....	400	32
55	Maurer's floating ground, below bridge, floated two weeks.	25	11:30	...do...	1	...do...	...do.....	.....do.....	.....	.....	.....	.....	200	5
56	Opposite Sundergard's boathouse. "naturals."	25	11.50	...do...	1	...do...	...do.....	.....do.....	.....	.....	.....	.....	100	4
57	Hammer's floating ground, floated one low tide, brought to the laboratory by Mr. Hammer.	July 2	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	350	41
58	Mason's floating ground, above bridge, floated one low tide.	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	4,900	23
59	Hammer's floating ground, below bridge, floated one tide.	10	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,300	50
60	Opposite Sundergard's boathouse, "naturals."	Aug. 6	10.15 a. m.	L.w...	2	E.....	Cloudy[1].	40.....	19.4	1.0020	80	+10	1,900	14
61	Below highway bridge, duplicate sample from bed No. 25, Conaskonk Point, floated one low tide.	6	10.30	F. beg.	2½	E.....	...do[1]...	100.....	19.4	1.0025	410	[2]+ .1	13,800	32
62	Below highway bridge, duplicate sample from bed No. 12, Conaskonk Point, floated one low tide.	6	10.30	...do...	2½	E.....	...do[1]....	100.....	19.4	1.0025	.....	.....	7,000	5
63	Above highway bridge, floated one low tide.	6	10.20	...do...	2½	E.....	...do[1]....	100.....	19.4	1.0025	160	+ 1	9,000	32
64	Below highway bridge, sample from 300 Conaskonk Point oysters deposited for observation Aug. 5, 1915, floated two low tides.	7	12.00 m.	...do...	2	SW...	Fair[1]...	100.....	.....	.....	.....	.....	1,000	140
65	.....do.....	7	12.00	...do...	2	SW....	...do[1]....	100.....	.....	.....	100	[2]+ .1	2,500	230
66	Below highway bridge, sample from oysters deposited for observation, floated six low tides.	9	2.00 p. m.	...do...	2	SW....	...do[1]....	100.....	32.2	1.0075	1,170	[2]+ .1	2,100	140
67	.....do.....	9	2.00	...do...	2	SW....	...do[1]....	100.....	32.2	1.0075	.....	.....	23,000	410
68	Below highway bridge, sample from oysters deposited for observation, floated eight low tides.	10	2.30	E. last.	2	NW....	...do.....	.....	.....	.....	.....	.....	1,400	50

69	Below highway bridge, floated two low tides.	1915 Nov. 19	12.15	Flood.	4	NW.	...do.....	10.....	22.2	1.0115	70	+ 1	1,100	28
70	.....do.....	19	12.20	...do...	6	NW.	...do.....	10.....	22.2	1.0120	98	+ 1	1,100	50
71	Above highway bridge, floated two tides.	19	12.30	...do...	5	NW.	...do.....	10.....	22.2	1.0120	100	+ 1	600	50
72	Below Ellsworth's shucking house, floated two tides.	19	12.35	...do...	5	NW.	...do.....	10.....	22.2	1.0120	108	[3] + .1	500	50
73	Ellsworth's shucking house, floated..	Nov. 16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	400	41
74	.....do.....	16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	500	28
75	.....do.....	16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	359	5
76	.....do.....	16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	3,050	50
77	.....do.....	16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	400	28
78	.....do.....	16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	650	28
79	.....do.....	16	2.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,900	41
80	Conaskonk Bar, floated 4 days.....	1916 June 12	11.30 a. m.	Ebb...	([2])	NW..	Clear....	.....	.....	.....	.....	+ .1	.....	140
82	Ellsworth's shucking house float.....	13	2.50 p. m.	Flood.	.....	W.....	...do....	.....	.....	.....	.....	+ .1	.....	230
83	Maurer float, floated 5 days.....	13	3.15	...do..	([2])	W.....	...do....	.....	.....	.....	.....	+ .01	.....	500
84	Wylie's Conaskonk bar, floated 18 hours, Maurer's float.	15	12.00 m.	Ebb...	([2])	E.....	Cloudy..	.....	.....	.....	.....	+ .1	.....	1

[1] Following stormy weather.

[2] Highest dilution planted.

[3] Surface.

TABLE J.—*Lupatcong Creek.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water samples. Number colonies per c. c., agar 37°, 48 hours.	Water samples. B. coli.
		1915.			*Feet.*				°C.			C. c.
1	Mouth	June 25	11.25 a.m.	L.w.	1	None	Fair	Slight			50	+ 1
2	Above highway bridge	25	11.40	do	1	do	do	do			60	+ 1
3	Mouth of storm sewer above Ellsworth's shucking house.	25	11.50	do	1	do	do	do			40	+10
4	75 yards above No. 3	25	11.55	do	1	do	do	do			90	−10
5	Sundergard's boathouse	25	12.00 m.	do	1	do	do	do			100	−10
6	do	26	9.00 a.m.	Ebb	2	do	Cloudy	Moderate			188	[1] + .1
7	Mouth of storm sewer	26	9.05	do	2	do	do	do			150	[1] + .1
8	Below highway bridge	26	9.08	do	2	do	do	do			138	[1] + .1
9	Mouth	26	9.10	do	3	do	do	do			168	[1] + .1
10	Sundergard's boathouse	28	6.00 p.m.	F. last	3	SW	Fair	Slight	25.0	1.0150	80	[1] + .1
11	Mouth of storm sewer	28	6.10	do	3	SW	do	do	23.8	1.0155	75	[1] + .1
12	Above highway bridge	28	6.15	do	4	SW	do	do	25.0	1.0150	42	[1] + .1
13	Mouth	28	6.20	do	5	SW	do	do	24.4	1.0155	74	[1] + .1
14	Sundergard's boathouse	29	6.15	do	3	SW	do	do	23.3	1.0160	25	+ 1
15	Mouth of storm sewer	29	6.20	do	3	SW	do	do	22.7	1.0165	37	+10
16	Below highway bridge	29	6.25	do	5	SW	do	do	22.7	1.0165	38	+10
17	Mouth	29	6.30	do	5	SW	do	do	22.7	1.0170	20	+ 1
18	Sundergard's boathouse	30	8.30 a.m.	do	3	SW	do	do	21.6	1.0180	36	.....
19	Mouth of storm sewer	30	8.35	do	3	SW	do	do	21.6	1.0180	37	.....
20	Below highway bridge	30	8.45	do	5	SW	do	do	21.6	1.0180	34	.....
21	Mouth	30	9.00	do	5	SW	do	do	21.6	1.0175	38	.....
22	Sundergard's boathouse	July 1	5.00 p.m.	L.w.	1	None	do [2]	Heavy			480	[1] + .1
23	Mouth of storm sewer	1	5.10	F. beg.	1	do	do [2]	do			290	[1] + .1
24	Above highway bridge	1	5.15	do	4	do	do [2]	do			290	[1] + .1
25	Storm sewer at culvert	1	5.12	do	3	do	do [2]	do			250	[1] + .1
26	Mouth	1	5.25	do	5	do	do [2]	do			245	[1] + .1
27	Sundergard's boathouse	2	6.00	do	3	NE	Rainy	Moderate			71	[1] + .1
28	Mouth of storm sewer	2	6.45	do	3	NE	do	do			168	[1] + .1
29	Under Ellsworth's shucking house	10	10.20 a.m.	Ebb	2	S	Fair	do	21.6	1.0065	203	+ 1
30	Under highway bridge	10	10.25	do	3	S	do	do	21.1	1.0070	230	[1] + .1
31	Mouth	10	10.28	do	4	S	do	do	21.6	1.0095	178	[1] + .1
32	Sundergard's boathouse	17	12.10 p.m.	do	2	NW	do	30	26.6	1.0140	310	[1] + .1
33	Mouth of storm sewer	17	12.15	do	2	NW	do	30	26.1	1.0140	390	+ 1
34	Under highway bridge	17	12.17	do	3	NW	do	30	26.6	1.0135	145	[1] + .1
35	Mouth	17	12.20	do	4	NW	do	30	26.6	1.0135	190	[1] + .1
36	Sundergard's boathouse	30	8.00	lc. beg.	3	NE	Cloudy [3]	Moderate	23.3	1.0150	110	+ 1

37	Mouth of storm sewer		20	3.05	...do		3	NE	...do[1]	...do	23.3	1.0150	110	[1]+ .1
38	Above highway bridge		20	3.10	...do		4	NE	...do[1]	...do	23.3	1.0150	100	[1]+ .1
39	Mouth		20	3.15	...do		5	NE	...do[1]	...do	23.8	1.0150	80	[1]+ 1
40	Mouth of storm sewer	Aug.	6	10.25 a.m.	L. w		1	E	...do[1]	60	19.4	1.0025	150	+ 1
41	Sundergard's boathouse		7	11.50	...do		1	SW	Fair[2]	60			20	+10
42	Mouth of storm sewer		7	11.55	...do		1	SW	...do[2]	60			45	−10
43	Sundergard's boathouse		9	1.45 p.m.	F. beg		3	SW	...do[2]	100	27.7	1.0050	370	[1]+ .1
44	Mouth of storm sewer		9	1.50	...do		3	SW	...do[2]	100	27.2	1.0050	1,100	[1]+ .1
45	Above highway bridge		9	1.55	...do		4	SW	...do[2]	100	26.6	1.0070	900	[1]+ .1
46	Sundergard's boathouse		10	2.30	E. last		1	NW	...do				270	+ 1
47	Mouth of storm sewer		10	2.30	...do		1	NW	...do				120	+ 1
48	Above highway bridge		10	2.30	...do		2	NW	...do				180	+ .1
49	Below highway bridge		10	2.30	...do		2	NW	...do				190	[1]+ .01
50	...do		18	9.00 a.m.	F. beg		2	NW	...do	20	20.5	1.0100	75	−10
51	...do		18	9.05	...do		2	NW	...do	20	20	1.0080	320	[1]+ .1
52	Above highway bridge		18	9.10	...do		2	NW	...do	20	20	1.0080	345	[1]+ .1
53	Below Ellsworth's shucking house		18	9.15	...do		2	NW	...do	20	20	1.0080	290	+ 1
		1916.												
81	Off Ellsworth's shucking house	June	12	11.35 a.m.	Ebb	(3)		NW	Clear					+ .1
85	Beatties Landing		13	3.05 p.m.	Flood	(3)		W	...do					+ .1
86	About 100 feet above Ellsworth's		15	12.30	Ebb	(3)		E	Cloudy					− 1
87	Culvert, Beers Street, 250 feet above Ellsworth's		15	12.40	...do	(3)		E	...do					− 1
88	Elizabeth Street Bridge		15	12.55	...do	(3)		E	...do					+ 1
89	1,000 feet below railroad		15	1.05	...do	(3)								− 1
90	100 yards above railroad		15	1.30	...do	(3)								− 1

[1] Highest dilution planted.

[2] Following stormy weather.

[3] Surface.

TABLE K.—*Cheesequake Creek.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				*C.*			*C. c.*		
1	Upper float	June 26	9.15 a. m.	Ebb	8	E	Rain	Moderate	20.5	1.0155	175	+1		
2	Above upper floating ground	26	9.20	do	8	E	do	do	20.5	1.0130	116	+1		
3	Lower float	July 2	1.00 p. m.	H. w.	10	NE	Cloudy	Slight	22.7	1.0170	26	+1		
4	Middle float	2	1.10	E. beg.	10	NE	do	do	22.7	1.0170	19	+1		
5	Upper float	2	1.20	do	8	NE	do	do	22.7	1.0170	21	+1		
6	Middle float	2	7.20	Flood	9	NE	do	Moderate	22.2	1.0115	75	+1		
7	Float below brickyard	June 26	8.55 a. m.	Ebb	8	E	Rain	do	21.1	1.0170	98	+1	100	1
8	Wm. Wooley floating ground	26	9.10	do	10	E	do	do	21.1	1.0160	108	+1	100	2
9	Lower float	July 2	7.15 p. m.	Flood	10	NE	Cloudy	do	22.7	1.0125	66	+1	100	14
10	Upper float	2	7.30	do	8	NE	do	do	22.1	1.0120	58	+1	100	3
		1916.												
11	Mouth Cheesequake Creek	June 12	2.00	do	(1)	NW	Clear					−1		
12	Between two drawbridges	12	2.00	do		NW	do					−1		
13	Opposite raceway	12	2.20	do	(1)	NW	do					+1		
14	Opposite brickyard	12	2.40	do	(1)	NW	do					−1		
15	Lower floating grounds	12	3.00	do		NW	do					+1		
16	Upper floating grounds, floated Conaskonk salts.	12	3.10	do	(1)	NW	do					+1		23
17	Head	12			(1)	NW	do					−1		
18	Head near Long Wharf	14	12.30 p. m.	H. w.	(1)	NE	do					−1		
19	Just below manure wharf	14	12.40	do	(1)	NE						−1		
20	Just below Perrin's dock	14	12.45	do	(1)	NE	Clear					+1		
21	Near high dock, east shore, upper floating grounds.	14	12.50	do	(1)	NE	do					+ .1		
22	Lower floating grounds, from Conaskonk Bar, floated 4 days.	14	1.00	E. beg.	(1)	NE	do					+1		3
23	Floating ground, just above brickyard	14	1.10	do	(1)	NE	do					+1		
24	Mouth of raceway	14	1.20	do	(1)	NE	do					+1		

[1] Surface.

TABLE L.—*Navesink River.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C. c.*		
1	Off steamboat wharf at Fairhaven	July 7	4.00 p. m.	Flood.	4	SE.	Fair	0	25.0	1.0130	37	+ 1	900	1
2	do	7	4.10	do	6	SE.	do	0	23.9	1.0130	38	+10	500	2
3	Off eastern shore at Fairhaven	7	4.20	do	4	SE.	do	0	24.3	1.0128	124	+10	700	1
4	Middle of river, opposite mouth McClees Creek.	7	4.30	do	6	SE.	do	0	23.9	1.0135	57	+10	300	2
5	Off western shore, below mouth McClees Creek.	7	4.35	do	5	SE.	do	0	23.9	1.0115	71	+10	1,100	2
6	Off eastern shore, at Lewis Point	7	4.40	do	5	SE.	do	0	23.9	1.0120	68	+10	300	3
7	Off western shore, above mouth McClees Creek.	7	4.45	do	5	SE.	do	0	23.9	1.0120	76	+ 1	1,500	23
8	100 yards off Robins Point	8	9.00 a. m.	Ebb	4	S.	Cloudy	0	22.7	1.0095	17	[1] + .1	400	3
9	Off McClures Point	8	9.25	do	8	S.	do	0	22.7	1.0120	18	+10	700	4
10	do	8	9.25	do	8	S.	do	0	22.7	1.0120			200	0
11	Walter Minton bed	8	9.35	do	8	S.	do	0	23.3	1.0120	18	+10	1,200	23
12	Off Guyon Point	8	9.50	do	8	S.	do	0	22.7	1.0115	30	+ 1	1,300	4
13	Off eastern shore at Fairhaven, opposite Chandler residence.	30	8.00	L. w.	4	W.	Fair	0	26.6	1.0140	176	+ 1	700	3
14	Off eastern shore at Fairhaven above No. 13.	30	8.30	do	4	W.	do	0	26.6	1.0140			2,400	32
15	Middle of river, opposite steamboat wharf at Fairhaven.	30	9.00	F. beg.	8	W.	do	0	26.6	1.0150	164	+ 1	5,400	32
16	Off McClees Point	30	9.15	do	3	W.	do	0	26.6	1.0140	76	[1] + .1	1,300	2
17	Off Lewis Point	30	9.30	do		W.	do	0	26.1	1.0140	126	+10	1,100	3
18	Mouth McClees Creek floating ground	30	9.25	do	2	W.	do	5	27.2	1.0125	225	+ 1		
19	Walter Minton bed	30	9.45	Flood.	6	W.	do	0	27.7	1.0140	290	+ 1	300,000	4
20	Off Robins Point	30	10.25	do	4	W.	do	0	28.3	1.0110	198	[1] + .1	700	3
21	Between old railroad and highway bridge, north side.	30	10.40	do	4	W.	do	0	28.3	1.0165	173	+ 1	3,200	23
22	200 yards off Guyon Point	30	11.00	do	8	None.	do	0	28.3	1.0120	156	+ 1	900	5
23	Mouth Red Bank sewage disposal plant.	30	10.35	do	8	W.	do	0	28.3	1.0125	380	+ 1		

[1] Highest dilution planted.

TABLE M.—*Shrewsbury River.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C. c.*		
1	Pleasure Bay, above Shallow Point	July 9	9.30 a. m.	Ebb	2½	NW	Fair	Moderate	21.1	1.0140	183	+1	600	23
2	Mouth Pleasure Bay, below Shallow Point, soft clams.	9	9.45	do	5	NW	do	do	21.1	1.0140	40	+10	400	2
3	Mouth of Little Silver Creek	9	10.00	do	3	NW	do	do	22.1	1.0130	155	+1	500	3
4	Below Red Light, above Gunning Island, hard clams.	9	10.30	do	5	NW	do	do	21.1	1.0155	7	+10	400	3
5	Pleasure Bay, above Shallow Point	30	2.40 p. m.	do	2	St	do	0	29.4	1.0125	265	+1	9,700	14
6	Pleasure Bay, off Patten Point, soft clams.	30	2.30	do	2	SE	Cloudy	0	29.4	1.0125	410	[1] +.1	1,200	1
7	Mouth of Blackberry Creek	30	3.12	do	5	SE	Fair	0	28.3	1.0140	85	+10	800	2

[1] Highest dilution planted.

TABLE N.—*Atlantic coast of New Jersey.*[1]

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Water, B. coli.	Shellfish, score based on B. coli shell liquor.
		1915.						*C. c.*	
1	Jenkins Sound, northeast part	Aug. 20	3.00 p. m.	H. W.	Surface.	None	Fair		2
2	Swains Channel, between Wildwood and Cape May, 1,000 yards from mouth	21	8.30 a. m.	Ebb	do	SE	Cloudy		1
3	Richardsons Channel, just off inland waterway route	21	8.30	do	do	SE	do		2
4	100 yards below Wildwood wagon bridge	21	9.00	do	do	SE	do		4
5	Taylors Sound	21	9.00	do	do	SE	do		2
6	300 yards below Wildwood Bridge—in branch off channel	21	9.30	do	do	SE	do		14
7	Eastern side of Lakes Bay, near Ventnor Canal	25	9.30	do	do	W	Fair		1
8	Western shore Lakes Bay; second oyster house below boulevard	25	10.00	do	do	W	do		0
9	Third oyster house below boulevard on western shore Lakes Bay	25	10.00	do	do	W	do		0
10	First oyster house below boulevard, Lake's Bay (western shore)	25	10.00	do	do	W	do		4
11	Sheepshank Thoroughfare (Absecon)	27	11.00	do	do	NE	Cloudy		0
12	do	27	11.00	do	do	NE	do		2
13	Absecon Creek	27	11.00	do	do	NE	do		2
14	do	27	11.00	do	do	NE	do		1
15	do	27	11.00	do	do	NE	do		0
16	Jenkins Sound	20	3.00	H. W.	do	None	Fair	−1	
17	do	20	3.00	do	do	do	do	−1	
18	do	20	3.00	do	do	do	do	−1	
19	do	20	3.00	do	do	do	do	−1	
20	do	20	3.00	do	do	do	do	−1	
21	do	20	3.00	do	do	do	do	−1	
22	do	20	3.00	do	do	do	do	−1	
23	do	20	3.00	do	do	do	do	−1	
24	do	20	3.00	do	do	do	do	−1	
25	do	20	3.00	do	do	do	do	−1	
26	Grassy Sound, at intervals	20	3.00	do	do	do	do	−1	
27	do	20	3.00	do	do	do	do	−1	
28	do	20	3.00	do	do	do	do	−1	
29	do	20	3.00	do	do	do	do	+ .1	
30	do	20	3.00	do	do	do	do	+1	
31	do	20	3.00	do	do	do	do	+ .01	
32	do	20	3.00	do	do	do	do	+ .1	
33	do	20	3.00	do	do	do	do	+1	
34	do	20	3.00	do	do	do	do	+1	
35	do	20	3.00	do	do	do	do	+ .1	
36	Jarvis Sound	21	8.00	Ebb	do	SE	Cloudy	−1	
37	do	21	8.00	do	do	SE	do	−1	
38	do	21	8.00	do	do	SE	do	−1	
39	do	21	8.00	do	do	SE	do	−1	
40	do	21	8.00	do	do	SE	do	−1	
41	Taylors Sound near Hann's oyster beds. (Sample No. 22 S)	21	8.30	do	do	SE	do	−1	
42	do	21	8.30	do	do	SE	do	−1	

TABLE N.—*Atlantic coast of New Jersey*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Water, B. coli.	Shellfish, score based on B. coli shell liquor.
		1915.							
43	Taylors Sound near Hann's oyster beds. (Sample No. 22 S)	Aug. 21	8.30 a.m.	Ebb	Surface	SE	Cloudy	−1	
44	do	21	8.30	do	do	SE	do	+1	
45	do	21	8.30	do	do	SE	do	−1	
46	Vicinity of Wildwood wagon bridge, along inland waterway	21	10.00	do	do	SE	do	−1	
47	do	21	10.00	do	do	SE	do	+ .1	
48	do	21	10.00	do	do	SE	do	+ .1	
49	do	21	10.00	do	do	SE	do	+ .1	
50	do	21	10.00	do	do	SE	do	+ .1	
51	do	21	10.00	do	do	SE	do	+ .1	
52	do	21	10.00	do	do	SE	do	+1	
53	do	21	10.00	do	do	SE	do	+ .1	
54	do	21	10.00	do	do	SE	do	+ .1	
55	do	21	10.00	do	do	SE	do	+1	
56	Lakes Bay, near center	25	9.30	do	do	W	Fair	−1	
57	do	25	9.30	do	do	W	do	−1	
58	do	25	9.30	do	do	W	do	−1	
59	do	25	9.30	do	do	W	do	−1	
60	do	25	9.30	do	do	W	do	−1	
61	From ditch over Mr. Mather's float, Lakes Bay	25	10.00	do	do	W	do	−1	
62	do	25	10.00	do	do	W	do	+1	
63	do	25	10.00	do	do	W	do	+ .1	
64	do	25	10.00	do	do	W	do	+ .1	
65	do	25	10.00	do	do	W	do	+1	
66	In ditch in which J. Hilton's float is located, Lakes Bay	25	10.30	do	do	W	do	−1	
67	do	25	10.30	do	do	W	do	+1	
68	do	25	10.30	do	do	W	do	−1	
69	do	25	10.30	do	do	W	do	+ .1	
70	do	25	10.30	do	do	W	do	+ .1	
71	In ditch flowing over Mr. Fish's float, Lakes Bay	25	10.30	do	do	W	do	−1	
72	do	25	10.30	do	do	W	do	+1	
73	do	25	10.30	do	do	W	do	−1	
74	do	25	10.30	do	do	W	do	−1	
75	do	25	10.30	do	do	W	do	+1	
76	Absecon Creek	27	11.00	do	do	NE	Cloudy	−1	
77	do	27	11.00	do	do	NE	do	−1	
78	do	27	11.00	do	do	NE	do	+1	
79	do	27	11.00	do	do	NE	do	−1	
80	do	27	11.00	do	do	NE	do	−1	
81	do	27	11.00	do	do	NE	do	−1	
82	do	27	11.00	do	do	NE	do	−1	
83	do	27	11.00	do	do	NE	do	−1	
84	do	27	11.00	do	do	NE	do	−1	
85	do	27	11.00	do	do	NE	do	−1	

TABLE O.—*Little Egg Harbor.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C. c.*		
1	J. W. Parker & Bros. shipping house, oysters from Tuckerton Bay, "Inlet."[1]	Dec. 13	10.00 a. m.	.....	.....	.....	.....	.....	.....	.....	.....	.....	270	3
2	Parker Bros. float, Tuckerton Creek[1]	13	10.00	.....	.....	.....	.....	.....	.....	.....	.....	.....	105	23
3	George Quinn float, Tuckerton Creek.[1]	13	10.10	Ebb..	.....	NW...	Stormy.	0	.....	.....	.....	.....	310	32
4	D. A. Mathis float, Tuckerton Creek[1]	13	10.15	...do...	.....	NW...	...do.....	.....	.....	.....	.....	.....	210	5
5	W. S. Allen float, Tuckerton Creek[1]	13	10.20	.....	.....	.....	.....	.....	.....	.....	.....	.....	225	14
6	Austin & Styles float, Tuckerton Creek.[1]	13	10.30	Ebb...	.....	NW...	Stormy.	0	.....	.....	.....	.....	225	3
7	.....do.[1]	13	10.35	...do...	.....	NW...	...do.....	.....	.....	.....	.....	.....	275	4
8	Arnold Cramer float, Tuckerton Creek.[1]	13	10.35	.....	.....	.....	.....	.....	.....	.....	.....	.....	335	4
9	.....do.[1]	13	10.45	.....	.....	.....	.....	.....	.....	.....	.....	.....	230	3
10	.....do.[1]	13	10.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	230	23
11	Float, West Creek[1]	14	8.00	Ebb...	.....	NW...	Fair.....	0	0.0	.....	.....	.....	380	0
12	.....do.[1]	14	8.10	...do...	.....	NW...	...do.....	0	0.0	.....	.....	.....	180	1
13	.....do.[1]	14	8.15	...do...	.....	NW...	...do.....	0	0.0	.....	.....	.....	1,800	0
14	.....do.[1]	14	8.20	...do...	.....	NW...	...do.....	0	0.0	.....	.....	.....	1,450	0
15	.....do.[1]	14	8.25	...do...	.....	NW...	...do.....	0	0.0	.....	.....	.....	270	3
16	Tuckerton Creek, opposite Parker Bros. float.[1]	15	8.30	...do...	.....	NW...	...do.....	0	0.0	.....	270	+ 1	.....	.....
17	Tuckerton Creek, opposite Mathis float.[1]	15	8.35	...do...	.....	NW...	...do.....	0	0.0	.....	43	+10	.....	.....
18	Tuckerton Creek, opposite Cramer float.[1]	15	8.45	...do...	.....	NW...	...do.....	0	0.0	.....	133	+10	.....	.....
19	Tuckerton Creek, ½ mile below dam at Tuckerton.[1]	15	9.05	...do...	.....	NW...	...do.....	0	0.0	.....	80	+ 1	.....	.....
20	Tuckerton Creek, 100 feet below dam[1]	15	9.20	...do...	.....	NW...	...do.....	0	0.0	.....	180	+10	.....	.....
21	West Creek, opposite lower floats[1]	15	1.15 p. m.	...do...	.....	NW...	...do.....	0	0.55	.....	150	+ 1	.....	.....
22	West Creek, opposite middle floats[1]	15	1.20	...do...	.....	NW...	...do.....	0	0.55	.....	92	+ 1	.....	.....
23	West Creek, opposite upper floats[1]	15	1.25	...do...	.....	NW...	...do.....	0	0.55	.....	119	−10	.....	.....
24	West Creek, ½ mile above upper floats.[1]	15	1.35	...do...	.....	NW...	...do.....	0	1.1	.....	340	+10	.....	.....
25	West Creek, at mouth of small branch below town of West Creek.[1]	15	1.45	...do...	.....	NW...	...do.....	0	1.1	.....	810	[2]+ .1	.....	.....

[1] The above samples were shipped from Tuckerton to Maurice River, N. J. before they were examined, the weather being very cold at the time.

[2] Highest dilution planted.

TABLE P.—*Barnegat Bay.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Oysters.	
											Number colonies per c. c., agar 37° 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			
1	Barnegat Creek [1]	Dec. 14									175	0
2	....do.[1]	14									130	0
3	....do.[1]	14									280	0
4	....do.[1]	14									860	2
5	....do.[1]	14									170	2

[1] These samples were taken from a batch of oysters which had been floated about one month in Barnegat Creek. They were shipped from Tuckerton, N. J., to Maurice River, N. J., before being examined, the weather at the time being very cold.

TABLE Q.—*Delaware River above Reedy Island.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.			Dissolved oxygen, parts per million.		
											Number colonies per c. c. agar 37° 48 hours.	B. coli.	Per cent saturation.	At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°C.			C. c.				
1	Torresdale, New Jersey side	Aug. 24	10.20 a. m.	Flood.	14	SW	Fair	0	23.8		[1] 500	[2] +0.1	82.9	7.10		
2	Torresdale, mid-channel	24	10.25	do.	25	SW	do.	0	23.8		[1] 143	[2] + .1	82.9	7.10	[1] 0.50	6.60
													85.2	7.30	7.00	.30
3	Torresdale, Pennsylvania side	24	10.30	do.	10	SW	do.	5	23.8		600	[2] + .1	82.9	7.10	7.10	.0
4	Bridesburg, Pennsylvania side	24	11.10	do.	12	SW	do.	80	23.8		10,000	[2] + .01	57.1	4.90	4.10	.80
5	Bridesburg, mid-channel	24	11.15	do.	30	SW	do.	80	23.8		[1] 1,140	.1	79.4	6.80	[1] 5.90	.90
													78.2	6.70	6.70	.0
6	Bridesburg, New Jersey side	24	11.20	do.	28	SW	do.	30	23.8		3,800	[2] + .01	75.9	6.50	6.40	.10
7	Coopers Point, New Jersey side	24	12.05 p. m.	do.	16	SW	do.	100	23.8		6,400	[2] + .001	35.0	3.00	2.20	.80
8	Coopers Point, mid-channel	24	12.10	do.	30	SW	do.	100	23.8		[1] 3,200	[2] + .001	39.7	3.40	(1)	
													38.5	3.30	2.90	.40
9	Coopers Point, Pennsylvania side	24	12.15	do.	47	SW	do.	100	23.8		11,300	[2] + .001	29.2	2.80	1.90	.60
10	Kaighn Point, New Jersey side	24	12.40	do.	36	SW	do.	100	23.8		4,700	[2] + .001	26.8	2.30	2.30	.0
11	Kaighn Point, mid-channel	24	12.45	do.	30	SW	do.	100	23.8		[1] 4,600	[2] + .001	24.5	2.10	[1] 1.50	.60
													22.1	1.90	1.10	.80
12	Kaighn Point, Pennsylvania side	24	12.50	do.	31	SW	do.	100	23.8		9,700	[2] + .001	11.6	1.00	1.00	.0
13	Gloucester Point, Pennsylvania side.	24	1.10	do.	43	SW	do.	75	23.8		37,000	[2] + .001	16.3	1.40	.80	.60
14	Gloucester Point, mid-channel	24	1.15	do.	43	SW	do.	75	23.8		[1] 16,000	[2] + .001	19.8	1.70	(1)	
													18.6	1.60	1.10	.50
15	Gloucester Point, New Jersey side	24	1.20	do.	17	SW	do.	75	23.8		6,500	+ .01			1.60	
16	League Island, New Jersey side	24	1.45	do.	22	SW	do.	80	23.8		1,400	+ .01	31.5	2.70	2.30	.40
17	League Island, mid-channel	24	1.50	do.	37	SW	do.	80	23.8		[1] 2,200	+ .01	19.8	1.70	[1] 1.20	.50
													18.6	1.60	1.50	.10
18	League Island, Pennsylvania side	24	2.00	F. last.	33	SW	do.	30	24.4		12,600	[2] + .001	22.4	1.90	1.10	.80
19	Mifflin Bar, New Jersey side	24	2.30	E. beg.	24	SW	do.	10	24.4		1,150	[2] + .01	36.6	3.10	2.50	.60
20	Mifflin Bar, mid-channel	24	2.35	do.	36	SW	do.	10	24.4		[1] 1,180	[2] + .01	30.6	2.60	[1] 2.00	.60
													29.6	2.50	2.10	.40
21	Mifflin Bar, Pennsylvania side	24	2.40	do.	31	SW	do.	10	24.4		3,700	[2] + .01	24.7	2.10	1.70	.40
22	Tinicum Island, New Jersey side	25	11.30 a. m.	Flood.	20	W	do.	75	24.4		3,800	+ .01	28.3	2.40	2.10	.30
23	Tinicum Island, mid-channel	25	11.37	do.	33	W	do.	100	24.4		[1] 14,000	+ .01	23.5	2.00	[1] 1.40	.60
													23.5	2.00	1.50	.50
24	Tinicum Island, Pennsylvania side.	25	11.45	do.	18	W	do.	60	24.4		43,500	[2] + .001	23.5	2.00	1.60	.40

[1] From bottom.

[2] Highest dilution planted.

TABLE Q.—*Delaware River above Reedy Island*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.			Dissolved oxygen, parts per million.		
											Number colonies per c. c. agar 37° 48 hours.	B. coli.	Per cent saturation.	At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°*C.*			*C. c.*				
25	Marcus Hook, New Jersey side...	25	12.45 p. m.	Flood.	16	W.....	Fair/....	125	24.4	.....	16,000	+ .1	46.0	3.90	3.50	.40
26	Marcus Hook, mid-channel.....	25	12.50	...do..	34	W.....	...do.....	100	24.4	.....	[1] 11,800	+ .1	42.6	3.70	[1] 3.20	.50
													41.3	3.50	2.80	.70
27	Marcus Hook, Pennsylvania side.	25	12.55	...do..	15	W.....	...do.....	100	24.4	.....	700	+ .01	37.7	3.20	2.70	.50
28	Gordon Heights, Delaware side...	25	1.30	...do..	23	W.....	...do.....	125	24.4	.....	1,700	+ .1	42.4	4.10	4.10	.0
29	Gordon Heights, mid-channel....	25	1.35	...do..	35	W.....	...do.....	125	24.4	.....	[1] 9,800	+ .1	42.4	4.10	[1] 4.10	.0
													46.0	3.90	4.30	+.40
30	Gordon Heights, New Jersey side.	25	1.40	F. last.	14	W.....	...do.....	125	24.4	.....	9,900	+ .1	53.1	4.50	3.70	.80
31	Pigeon Point, New Jersey side...	25	2.10	E. beg.	52	W.....	...do.....	100	24.4	.....	15,000	+ .1	60.4	5.10	4.50	.60
32	Pigeon Point, mid-channel.....	25	2.15	...do..	35	W.....	...do.....	100	24.4	.....	[1] 5,800	− .1	57.8	4.90	[1] 4.60	.30
													56.6	4.80	4.10	.70
33	Pigeon Point, Delaware side.....	25	2.20	...do..	15	W.....	...do.....	100	24.4	.....	13,800	[2]+ .001	46.0	3.90	3.70	.20
34	Reedy Island, New Jersey side...	25	3.30	Ebb...	14	W.....	...do.....	150	24.4	.....	24,000	+ .1	77.9	6.60	6.00	.60
35	Reedy Island, mid-channel.....	25	3.35	...do..	33	W.....	...do.....	150	24.4	.....	[1] 4,300	+ .1	70.8	6.00	[1] 5.30	.70
													72.1	6.10	5.40	.70
36	Reedy Island, Delaware side.....	25	3.49	...do..	20	W.....	...do.....	150	24.4	.....	2,000	− .1	69.8	5.90	4.80	1.10
37	Reedy Island, New Jersey side...	27	11.10 a. m.	Flood.	14	NE...	Cloudy..	150	23.3	.....	270	+ .1	76.4	6.60	6.10	.50
38	Reedy Island, mid-channel.....	27	11.15	...do..	33	NE...	...do.....	125	23.3	.....	[1] 720	+ .1	68.3	5.90	[1] 5.20	.70
													75.3	6.50	5.70	.80
		1915														
39	Reedy Island, Delaware side.....	Aug. 27	11.20 a. m.	Flood.	20	NE...	Cloudy..	150	23.3	.....	210	+0.1	73.0	6.30	6.50	+0.20
40	Pigeon Point, Delaware side.....	27	11.20	...do..	11	NE...	...do.....	125	23.3	.....	1,800	+ .1	56.5	4.90	4.70	.20
41	Pigeon Point, mid-channel.....	27	12.25 p. m.	...do..	31	NE...	...do.....	125	23.3	.....	[1] 5,400	− .1	57.9	[1] 5.00	5.10	+ .10
													59.0	5.10	4.40	.70
42	Pigeon Point, New Jersey side.....	27	12.30	...do..	48	NE...	.....	125	23.3	.....	2,400	+ .1	57.9	5.00	5.10	+ .10
43	Gordon Heights, New Jersey side.	27	1.00	...do..	11	NE...	...do.....	125	23.3	.....	2,500	+ .1	53.3	4.60	4.20	.40
44	Gordon Heights, mid-channel....	27	1.10	...do..	32	NE...	...do.....	125	23.3	.....	[1] 5,600	+ .1	47.5	[1] 4.10	4.20	+ .10
													48.6	4.20	4.10	.10
45	Gordon Heights, Delaware side...	27	1.15	...do..	20	NE...	...do.....	100	23.3	.....	1,200	+ .1	49.8	4.30	4.10	.20
46	Marcus Hook, Pennsylvania side.	27	1.45	...do..	12	NE...	...do.....	40	23.3	.....	2,000	+ .1	32.4	2.80	2.60	.20
47	Marcus Hook, mid-channel.....	27	1.50	...do..	33	NE...	...do.....	40	23.3	.....	[1] 1,800	+ .01	41.7	[1] 3.60	3.70	+ .10
													44.0	3.80	3.80	.00
48	Marcus Hook, New Jersey side....	27	1.55	...do..	15	NE...	...do.....	40	23.3	.....	1,600	+ .1	49.8	4.30	4.40	+ .10
49	Tinicum Island, Pennsylvania side	27	1.30	...do..	19	NE...	...do.....	30	23.3	.....	5,800	+ .01	24.3	2.10	2.10	.00
50	Tinicum Island, mid-channel.....	27	1.35	...do..	34	NE...	...do.....	40	23.3	.....	[1] 3,400	+ .01	33.6	[1] 2.90	2.10	.80
													34.7	3.00	2.80	.20

51	Tinicum Island, New Jersey side..		27	1.40	...do..	21	NE...	...do.....	30	23.3	.....	2,100	+ .01	39.3	3.40	3.30	.10		
52	Mifflin Bar, Pennsylvania side....		27	3.10	...do..	31	NE...	...do.....	30	23.3	.....	7,300	[2]+ .001	31.2	2.70	2.50	.20		
53	Mifflin Bar, mid-channal.....		27	3.15	...do..	36	NE...	...do.....	30	23.3	.....	[1]5,500	[2]+ .001	28.9	[1]2.50	2.40	.10		
														30.1	2.60	2.30	.30		
54	Mifflin Bar, New Jersey side.....		27	3.20	...do..	24	NE...	...do.....	30	23.3	.....	4,000	+ .1	34.7	3.00	3.20	+ .20		
55	League Island, Pennsylvania side		27	3.40	...do..	35	NE...	...do.....	25	23.3	.....	9,400	+ .01	31.2	2.70	2.50	.20		
56	League Island, mid-channel.....		27	3.45	...do..	39	NE...	...do.....	25	23.3	.....	[1]6,000	[2]+ .001	37.0	[1]3.20	2.80	.40		
														37.0	3.20	3.10	.10		
57	League Island, New Jersey side...		27	3.50	...do..	23	NE...	...do.....	25	23.3	.....	2,800	+ .01	44.0	3.80	3.40	.40		
58	Torresdale, Pennsylvania side....		28	11.25 a.m.	Ebb..	12	NE...	...do.....	25	20.5	.....	200	+ .1	74.8	6.80	5.60	1.20		
59	Torresdale, mid-channel.....		28	11.30	...do..	30	NE...	...do.....	25	20.5	.....	[1]200	+ .1	77.0	[1]7.00	6.60	.40		
														75.8	6.90	7.00	+ .10		
60	Torresdale, New Jersey side.....		28	11.35	...do	16	NE...	...do.....	25	20.5	.....	600	+ .1	74.8	6.80	6.80	.00		
61	Bridesburg, Pennsylvania side...		28	12.00 m.	E. last	10	NE...	...do.....	50	20.5	.....	1,200	+ .01	71.5	6.50	6.50	.00		
62	Bridesburg, mid-channel.....		28	12.05 p.m.	...do..	28	NE...	...do.....	50	20.5	.....	[1]400	+ .1	72.6	[1]6.60	6.50	.10		
														75.8	6.90	6.80	.10		
63	Bridesburg, New Jersey side.....		28	12.10	...do..	26	NE...	...do.....	50	20.5	.....	300	− .1	73.6	6.70	6.60	.10		
64	Coopers Point, New Jersey side...		28	12.40	F.beg.	14	NE...	Rain....	60	21.1	.....	4,000	+ .001	49.0	4.40	3.00	1.40		
65	Coopers Point, mid-channel.....		28	12.45	...do..	30	NE...	...do.....	60	21.1	.....	[1]5,000	+ .001	66.8	[1]6.00	5.90	.10		
														66.8	6.00	5.70	.30		
66	Coopers Point, Pennsylvania side.		28	12.50	...do..	45	NE...	...do.....	60	21.1	.....	12,000	+ .001	45.7	4.10	3.40	.70		
67	Kaighn Point, New Jersey side...		28	1.10	...do..	29	NE...	...do.....	75	21.6	.....	3,000	+ .01	53.9	4.80	4.60	.20		
68	Kaighn Point, mid-channel.....		28	1.15	...do..	28	NE...	...do.....	75	21.6	.....	[1]12,000	− .01	47.2	[1]4.20	3.10	1.10		
														44.9	4.00	3.40	.60		
69	Kaighn Point, Pennsylvania side.		28	1.25	Flood.	34	NE...	...do.....	75	21.6	.....	10,000	[2]+ .0001	29.2	2.60	2.00	.60		
70	Gloucester Point, Pennsylvania side.....		28	4.30	...do..	38	NE...	...do.....	50	21.6	.....	5,000	+ .01	39.3	3.50	2.90	.60		
71	Gloucester Point, mid-channel....		28	4.35	...do..	32	NE...	...do.....	50	21.6	.....	[1]2,000	− .01	47.2	[1]4.20	3.80	.40		
														44.9	4.00	3.80	.20		
72	Gloucester Point, New Jersey side		28	4.40	...do..	33	NE...	...do.....	50	21.6	.....	5,000	+ .01	49.4	4.40	4.10	.30		
73	Torresdale, Pennsylvania side....		30	2.55	...do..	11	NE...	Cloudy..		20.0	.....	1,340	+ .1	76.3	7.00	6.65	.35		
74	Torresdale, mid-channel.....		30	3.00	...do..	15	NE...	...do.....		20.0	.....	[1]820	+ .1	81.7	[1]7.50	7.30	.20		
														82.3	7.55	7.15	.40		
75	Torresdale, New Jersey side.....		30	3.10	...do..	15	NE...	...do.....		20.0	.....	2,440	+1	69.2	6.35	6.60	+ .25		
		1915																	
76	Bridesburg, Pennsylvania side..	Aug.	30	3.45 p.m.	Flood.	33	NE...	...do.....		20.5	.....	40,000	[2]+ .001	60.0	5.45	4.35	1.10		
														73.2	6.65	[1]6.35	.30		
77	Bridesburg, mid-channel.....		30	3.50	...do..	15	NE...	...do.....		20.5	.....	[1]7,600	+ .1	70.4	6.40	6.45	+ .50		
78	Bridesburg, New Jersey side.....		30	3.55	...do..	20	NE...	...do.....		20.5	.....	3,600	+ .01	74.3	6.85	6.65	.20		
79	Coopers Point, New Jersey side..		30	4.20	...do..	15	NE...	...do.....		21.1	.....	17,000	− .01	46.2	4.15	3.70	.45		
80	Coopers Point, mid-channel.....		30	4.30	...do..	30	NE...	...do.....		21.1	.....	[1]23,000	+ .01	48.4	4.35	[1]3.65	.70		
														44.5	4.00	3.65	.35		
81	Coopers Point, Pennsylvania side.		30	4.35	...do..	46	NE...	...do.....		21.1	.....	33,000	+ .001	36.2	3.25	2.45	.80		
82	Kaighn Point, New Jersey side..		30	4.50	...do..	31	NE...	...do.....		21.6	.....	16,000	− .01	44.9	4.00	3.60	.40		
83	Kaighn Point, mid-channel.....		30	5.00	...do..	36	NE...	...do.....		21.6	.....	[1]4,000	− .01	42.7	3.80	[1]3.55	.25		
84	Kaighn Point, Pennsylvania side.		30	5.05	...do..	36	NE...	...do.....		21.6	.....	8,000	+ .01	34.3	3.05	2.95	.10		
85	Gloucester Point, New Jersey side.		30	5.30	...do..	17	NE...	...do.....		21.6	.....	3,000	− .01	43.3	3.85	3.40	.45		
86	Gloucester Point, mid-channel...		30	5.35	...do..	43	NE...	...do.....		21.6	.....	[1]6,000	+ .01	36.5	3.25	[1]2.80	.45		
														35.9	3.20	2.35	.85		

[1] From bottom.

[2] Highest dilution planted.

TABLE Q.—*Delaware River above Reedy Island*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity. m	Temperature. m	Salinometer reading.	Bacteria in water.			Dissolved oxygen, parts per million.		
											Number colonies per c. c. agar 37° 48 hours.	B. coli.	Per cent saturation.	At once.	24 hours at 20°.	Loss.
		1913.			*Feet.*				° *C.*			*C. c.*				
87	Gloucester Point, Pennsylvania side.	Aug. 30	5.40 p. m.	Flood..	20	NE....	Cloudy..	.....	21.6	.....	34,000	+ .01	35.9	3.20	2.40	.80
88	League Island, New Jersey side..	31	2.15	...do..	18	N.....	Fair....	60	21.1	.....	1,200	+ .01	44.5	4.00	3.70	.30
89	League Island, mid-channel.....	31	2.20	...do..	34	N.....	...do....	60	21.1	.....	[1] 2,000	+ .01	44.5	4.09	[1] 3.45	.55
													44.5	4.00	3.35	.65
90	League Island, Pennsylvania side.	31	2.25	...do..	29	N.....	...do....	60	21.1	.....	12,700	[2]+ .001	34.5	3.10	2.99	.20
91	Mifflin Bar, New Jersey side.....	31	2.55	...do..	19	N.....	...do....	60	21.1	.....	1,600	[2]+ .001	43.4	3.90	2.90	1.00
92	Mifflin Bar, mid-channel.....	31	3.00	...do..	30	N.....	...do....	60	21.1	.....	[1] 3,600	+ .01	38.4	3.45	[1] 2.65	.80
													36.2	3.25	3.05	.20
93	Mifflin Bar, Pennsylvania side...	31	3.05	...do..	26	N.....	...do....	30	21.1	.....	14,600	[2]+ .001	37.9	3.40	2.95	.45
94	Tinicum Island, New Jersey side.	31	3.45	...do..	18	N.....	...do....	25	21.1	.....	700	+ .01	49.0	4.40	4.75	+ .35
95	Tinicum Island, mid-channel....	31	3.50	...do..	34	N.....	...do....	50	21.1	.....	[1] 800	+ .1	42.9	3.85	[1] 3.30	.55
													44.0	3.95	4.09	+ .50
96	Tinicum Island, Pennsylvania side.	31	4.00	...do..	13	N.....	...do....	50	21.1	.....	3,300	+ .1	41.8	3.75	3.15	.60
97	Marcus Hook, New Jersey side...	31	5.05	...do..	16	N.....	...do....	20	21.1	.....	500	+ .1	58.5	5.25	4.70	.55
98	Marcus Hook, mid-channel.....	31	5.10	...do..	34	N.....	...do....	20	21.1	.....	[1] 300	+ .1	47.3	4.25	[1] 4.05	.20
													50.1	4.50	4.40	.10
99	Marcus Hook, Pennsylvania side.	31	5.15	...do..	13	N.....	...do....	20	21.1	.....	400	− .1	47.9	4.30	4.00	.30
100	Gordon Heights, Delaware side..	31	6.10	...do..	29	N.....	...do....	60	21.1	.....	600	+ .1	57.4	5.15	4.70	.45
101	Gordon Heights, mid-channel....	31	6.15	...do..	36	N.....	...do....	50	21.1	.....	.....	.....	59.6	5.35	[1] 5.20	.15
													58.5	5.25	4.20	1.05
102	Gordon Heights, New Jersey side.	31	6.25	F.last	52	N.....	...do....	50	21.1	.....	.....	.....	62.4	5.60	5.25	.35
103	Pigeon Point, New Jersey side...	31	6.55	E.beg	19	N.....	...do....	40	21.1	.....	.....	.....	65.7	5.90	5.60	.30
104	Pigeon Point, mid-channel.....	31	7.00	...do..	36	N.....	...do....	30	21.1	.....	.....	.....	67.4	6.05	[1] 5.90	.15
													68.0	6.10	5.45	.65
105	Pigeon Point, Delaware side.....	31	7.05	...do..	13	N.....	...do....	40	21.1	.....	.....	.....	60.7	5.45	5.35	.10
106	Reedy Island, New Jersey side...	Sept. 1	8.30 a. m.	Ebb..	16	NE....	...do....	60	20.0	.....	100	+ .1	76.3	7.00	7.20	+ .20
107	Reedy Island, mid-channel.....	1	8.35	...do..	36	NE....	...do....	60	20.0	.....	[1] 400	− .1	74.1	6.80	[1] 7.00	+ .20
													74.1	6.80	6.90	+ .10
108	Reedy Island, Delaware side.....	1	8.40	...do..	22	NE....	...do....	60	20.0	.....	200	− .1	74.7	6.85	7.05	+ .20
109	Opposite Pigeon Point channel...	Oct. 13	2.00 p. m.	Flood.	33	S.....	Cloudy..	75	16.6	1.0050	1,500	− .1	.....	.....	.....	.....
110	Opposite New Castle channel....	13	2.30	...do..	33	S.....	...do....	75	16.1	1.0060	1,500	+ .1	.....	.....	.....	.....
111	Opposite Delaware City channel, New Jersey side.	13	3.00	...do..	34	S.....	...do....	75	16.1	1.0060	1,200	− .1	.....	.....	.....	.....

	New Jersey side														
113	Opposite Pigeon Point channel...	15	3.30	...do...	33	None..	Fair	100	17.2	.....	75	+1	.....	.....	.....
114	Opposite New Castle channel.....	15	3.05	...do..	33	...do..	...do....	60	17.2	.....	25	+1	.....	.....	.....
115	Opposite Delaware City channel, New Jersey side.	15	2.45 p.m.	Flood.	34	None .	...do.....	30	17.2	.....	Spr.	+ .1	.....	.....	.....
116	Opposite Reedy Island channel, New Jersey side.	15	2.20	...do..	35	...do..	...do.....	40	17.2	.....	Spr.	+1	.....	.....	.....
117	Pigeon Point, Delaware side.....	16	9.30 a.m.	Ebb ..	13	E.....	Cloudy..	100	16.3	1.0015	2,500	− .1	.....	.....	.....
118	....do.....	16	9.30	...do..	13	E.....	...do....	100	16.3	1.0015	[1] 2,000	+ .1	.....	.....	.....
118a	Pigeon Point channel.....	16	9.35	...do..	33	E.....	...do....	100	16.3	1.0015	[1] 5,000	+ .1	.....	.....	.....
118b	Pigeon Point, channel side.....	16	9.35	...do..	33	E.....	...do....	100	16.3	1.0015	2,000	+ .1	.....	.....	.....
119	Pigeon Point, New Jersey side...	16	9.40	...do..	50	E.....	...do....	100	16.3	1.0015	59,000	+ .1	.....	.....	.....
120	Above mouth of Christiana Creek.	16	10.00	...do..	33	E.....	...do....	100	16.3	1.0015	7,500	+ .1	.....	.....	.....
121	Gordon Heights, Pennsylvania side.	16	10.16	...do..	26	E.....	...do....	100	16.3	1.0005	3,500	+ .1	.....	.....	.....
122a	Gordon Heights channel.....	16	10.30	...do..	33	E.....	...do....	100	16.6	1.0005	[1] 2,500	+ .1	.....	.....	.....
122b	....do.....	16	10.30	...do..	33	E.....	...do....	100	16.6	1.0005	6,000	+ .01	.....	.....	.....
123	Gordon Heights, New Jersey side.	16	10.30	...do..	27	E.....	...do....	100	16.6	1.0005	4,500	+ .1	.....	.....	.....
124	Marcus Hook, Pennsylvania side.	16	11.00	...do..	13	E.....	...do....	30	17.2	.9995	1,000	+ .1	.....	.....	.....
125	Marcus Hook channel.....	16	11.00	...do..	34	E.....	...do....	30	17.2	1.0000	[1] 2,000	+ .01	.....	.....	.....
125b	....do.....	16	11.00	...do..	34	E.....	...do....	30	17.2	1.0000	2,000	− .1	.....	.....	.....
126	Marcus Hook, New Jersey side...	16	11.00	...do..	16	E.....	...do....	30	17.2	1.0000	2,500	+ .1	.....	.....	.....
127	Tinicum Island, Pennsylvania side.	16	12.00 m.	...do..	15	E.....	...do....	25	16.9	.9995	2,500	+ .1	.....	.....	.....
128	Tinicum Island channel.....	16	12.02 p.m.	...do..	36	E.....	...do....	25	16.9	.9995	[1] 5,000	+ .01	.....	.....	.....
128b	....do.....	16	12.02	...do..	36	E.....	...do....	25	16.9	.9995	6,000	+ .1	.....	.....	.....
129	Tinicum Island, New Jersey side.	16	12.05	...do..	22	E.....	...do....	25	16.9	.9995	8,000	+ .1	.....	.....	.....
130	Mifflin Bar, Pennsylvania side...	16	1.00	...do..	30	E.....	...do....	40	16.9	.9990	63,500	+ .001	.....	.....	.....
131	Mifflin Bar channel.....	16	1.05	...do..	35	E.....	...do....	40	16.9	.9990	[1] 4,500	− .01	.....	.....	.....
131b	....do.....	16	1.05	...do..	35	E.....	...do....	40	16.9	.9990	5,500	+ .01	.....	.....	.....
132	Mifflin Bar, New Jersey side.....	16	1.00	...do..	23	E.....	...do....	40	16.9	.9990	5,500	+ .01	.....	.....	.....
133	League Island, Pennsylvania side	16	1.30	...do..	34	E.....	...do....	25	16.9	.9990	66,000	[2]+ .0001	.....	.....	.....
134	League Island channel.....	16	1.30	...do..	39	E.....	...do....	25	16.9	.9990	[1] 53,000	+ .001	.....	.....	.....
134b	....do.....	16	1.30	...do..	39	E.....	...do....	25	16.9	.9990	44,500	+ .001	.....	.....	.....
135	League Island, New Jersey side..	16	1.35	...do..	23	E.....	...do....	40	16.9	.9990	26,500	+ .01	.....	.....	.....
136	Opposite Pigeon Point channel...	18	11.20 a.m.	...do..	33	S.....	...do....	100	16.6	1.0000	1,750	+ .1	.....	.....	.....
137	Opposite New Castle channel....	18	11.40	...do..	33	S.....	...do....	75	16.6	1.0005	700	+1	.....	.....	.....
138	Opposite Delaware City, channel, New Jersey side.	18	12.10 p.m.	...do..	32	S.....	...do....	75	16.6	1.0020	295	+1	.....	.....	.....
139	Opposite Reedy Island channel, New Jersey side.	18	12.40	...do..	32	S.....	...do....	30	16.6	1.0025	210	+1	.....	.....	.....
140	Opposite Pigeon Point channel..	22	7.00 a.m.	L. w..	36	None .	Fair.....	100	16.6	1.0000	500	+ .1	.....	.....	.....
141	Opposite New Castle channel.....	22	7.30	F. beg.	36	...do..	...do.....	100	16.6	1.0000	250	+10	.....	.....	.....
142	Opposite Delaware City channel, New Jersey side.	22	8.00	...do..	35	...do..	...do.....	40	17.2	1.0020	30	[2]+ .1	.....	.....	.....
143	Opposite Reedy Island channel, New Jersey side.	22	8.30	Flood.	35	...do..	...do.....	10	17.2	1.0035	73	+1	.....	.....	.....
144	....do.....	23	9.00	...do..	33	N.....	...do.....	.....	16.1	1.0020	12	−10	.....	.....	.....
145	Opposite Delaware City channel, New Jersey side.	23	9.30	...do..	34	N.....	...do.....	.....	16.1	1.0010	19	−10	.....	.....	.....

[1] From bottom.

[2] Highest dilution planted.

TABLE Q.—*Delaware River above Ready Island*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.			Dissolved oxygen, parts per million.		
											Number colonies per c. c. agar 37° 48 hours.	B. coli.	Per cent saturation.	At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				° *C.*			*C. c.*				
146	Opposite New Castle channel	23	10.00	Flood.	34	N	Fair		16.1	1.0000	48	−10				
147	Opposite Pigeon Point channel	23	10.30	...do..	34	N	...do		16.1	1.0000	45	−10				
148	Opposite New Castle channel	26	8.30	...do..	33	SW	Cloudy..	100	15.5	1.0000	6,000	[2]+ .1				
149	Opposite Delaware City channel, New Jersey side.	26	9.10	...do..	33	SW	...do	75	14.4	1.0015	3,930	+1				
150	Opposite Reedy Island channel, New Jersey side.	26	9.45	...do..	34	SW	...do	10	14.7	1.0025	720	+1				
151	Opposite Pigeon Point channel	Nov. 8	1.15 p. m.	...do..	33		Fair	100			3,290	+ .1				
152	Opposite New Castle channel	8	1.45	...do..	33		...do	100			2,510	+ 1				
153	Opposite Delaware City channel	8	2.15	F. last.	34		...do	75			Spr.	+ 1				
154	Opposite Reedy Island, New Jersey side.	8	2.45	E. beg.	34		...do	20			86	+10				
155	Junction of channels below Bordentown.	Dec. 4	8.30 a. m.	L. w...	16	None	...do	15	2.7		200	[2]+ .1				
156	Opposite Roebling	4	8.45	...do..	14	...do..	...do	20	2.7		115	[2]+ .1				
157	Opposite Florence	4	9.10	F. beg.	21	...do..	...do	20	2.7		53	[2]+ .1				
158	Opposite Bristol	4	9.30	Flood.	22	...do..	...do	15	2.7		73	+ 1				
159	Opposite Beverly	4	10.00	...do..	31	NW	...do	15	2.7		67	[2]+ .1				
160	Opposite Andalusia	4	10.20	...do..	14	NW	...do	10	3.7		145	[2]+ .1				
161	Torresdale, Pennsylvania side	4	10.35	...do..	13	NW	Cloudy..	10	2.7		212	+ .1				
162	Torresdale channel	4	10.39	...do..	32	NW	...do	10	2.7		105	+ 1				
163	Torresdale, New Jersey side	4	10.42	...do..	18	NW	...do	25	2.7		138	+ .1				
164	Bridesburg, Pennsylvania side	4	11.15	...do..	14	NW	...do	25	2.7		325	+ .1				
165	Bridesburg channel	4	11.15	...do..	32	NW	...do	25	2.7		520	[2]+ .01				
166	Bridesburg, New Jersey side	4	11.15	...do..	30	NW	...do	25	2.7		390	+ .1				
167	Kaighn Point, New Jersey side	6	12.00 m.	...do..	33	NW	...do	35	5.5		240	+ .1				
168	Kaighn Point channel	6	12.00	...do..	32	NW	...do	35	5.5		265	+ .1				
169	Kaighn Point mid-channel	6	12.00	...do..	32	NW	...do	35	5.5		[1] 285	+ .01				
170	Kaighn Point, Pennsylvania side.	6	12.00	...do..	38	NW	...do	30	5.5		385	+ .01				
171	Gloucester, New Jersey side	6	12.30 p. m.	...do..	18	NW	...do	50	5.5		150	+ .01				
172	Gloucester channel	6	12.30	...do..	44	NW	...do	50	5.5		275	+ .01				
173	....do	6	12.30	...do..	44	NW	...do	50	5.5		[1] 165	+ .01				
174	Gloucester, Pennsylvania side	6	12.30	...do..	21	NW	...do	50	5.5		185	+ .01				
175	League Island, New Jersey side	6	1.00	...do..	23	NW	...do	35	5.5		240	− .1				
176	League Island channel	6	1.00	...do..	39	NW	...do	30	5.5		315	+ .1				

179	Mifflin Bar, New Jersey side		6	1.00	...do..	34	NW	...do....	30	5.5	.....	[1] 245	+	.1	.....	.....	.....	.....
180	Mifflin Bar channel		6	1.30	...do..	24	NW	...do....	25	5.5	.....	255	+	.1	.....	.....	.....	.....
181	Mifflin Bar		6	1.30	...do..	36	NW	...do....	25	5.5	.....	100	+	.1	.....	.....	.....	.....
182	Mifflin Bar, Pennsylvania side		6	1.30	...do..	36	NW	...do....	25	5.5	.....	185	−	.1	.....	.....	.....	.....
183	Tinicum Island, New Jersey side		6	2.00	F. last	21	NW	...do....	25	5.5	.....	[1] 390	+	.1	.....	.....	.....	.....
184	Tinicum Island channel		6	2.00	...do..	38	NW	...do....	30	5.5	.....	330	+	.1	.....	.....	.....	.....
185	....do		6	2.00	...do..	38	NW	...do....	25	5.5	.....	265	+	.1	.....	.....	.....	.....
186	Tinicum Island, Pennsylvania side		6	2.00	...do..	20	NW	...do....	25	5.5	.....	245	−	.1	.....	.....	.....	.....
187	Marcus Hook, New Jersey side		6	2.45	E. beg.	18	NW	...do....	25	5.5	.....	[1] 215	−	.1	.....	.....	.....	.....
188	Marcus Hook channel		6	2.45	...do..	36	NW	...do....	35	5.5	.....	165	−	.1	.....	.....	.....	.....
189	....do		6	2.45	...do..	36	NW	...do....	35	5.5	.....	120	+	.1	.....	.....	.....	.....
190	Marcus Hook, Pennsylvania side		6	2.45	...do..	15	NW	...do....	35	5.5	.....	210	−	.1	.....	.....	.....	.....
191	Gordon Heights, Delaware side		6	3.20	Ebb	28	NW	...do....	40	5.5	.....	[1] 115	+	.1	.....	.....	.....	.....
192	Gordon Heights (Del.) channel		6	3.20	...do..	35	NW	...do....	50	5.5	.....	95	+	.1	.....	.....	.....	.....
193	....do		6	3.20	...do..	35	NW	...do....	75	5.5	.....	130	+	.1	.....	.....	.....	.....
194	Gordon Heights, New Jersey side		6	3.20	...do..	24	NW	...do....	75	5.5	.....	100	−	.1	.....	.....	.....	.....
195	Pigeon Point, New Jersey side		6	3.50	...do..	51	NW	...do....	100	5.5	.....	[1] 110	+	.1	.....	.....	.....	.....
196	Pigeon Point channel		6	3.50	...do..	34	NW	...do....	100	5.5	.....	245	+	.1	.....	.....	.....	.....
197	....do		6	3.50	...do..	34	NW	...do....	60	5.5	.....	180	−	.1	.....	.....	.....	.....
198	Pigeon Point, Delaware side		6	3.50	...do..	14	NW	...do....	60	5.5	.....	[1] 135	−	.1	.....	.....	.....	.....
199	Pigeon Point mid-channel		8	9.30 a. m.	Flood	33	NW	...do....	75	5.5	.....	135	+	.1	.....	.....	.....	.....
200	Opposite New Castle		8	10.00	...do..	33	NW	...do....	100	3.8	.....	260	+	.1	.....	.....	.....	.....
201	Opposite Delaware City, channel		8	11.30	...do..	34	NW	...do....	100	3.8	.....	88	+	.1	.....	.....	.....	.....
202	Reedy Island, Delaware side		8	11.45	...do..	32	NW	...do....	100	3.8	.....	33	+	1	.....	.....	.....	.....
203	Reedy Island channel		8	11.45	...do..	34	NW	...do....	100	3.8	.....	35	+	1	.....	.....	.....	.....
204	....do		8	11.50	...do..	34	NW	...do....	75	3.8	.....	48	+	1	.....	.....	.....	.....
205	Reedy Island, New Jersey side		8	11.50	...do..	13	NW	...do....	75	3.8	.....	[2] 33	+	.1	.....	.....	.....	.....
206	Christiana River, bridge	Oct.	13	11.00	...do..	.....	W	Fair.....	25	15.0	.....	[1] 38	+	1	.....	.....	.....	.....
207	Christiana River, Delaware pulp mills.		13	11.20	...do..	.....	W	...do....	40	15.8	.....	33	+	1	.....	.....	.....	.....
208	Christiana River, Harlan & Hollingsworth pulp mills.		13	11.35	...do..	.....	W	...do....	100	15.5	.....	300	+	.01	.....	.....	.....	.....
209	Christiana River, below Third Street Bridge.		13	1.20 p. m.	...do..	.....	W	...do....	100	15.5	.....	4,000	−	.01	.....	.....	.....	.....
210	Christiana River, mouth of Brandywine Creek.		13	1.28	...do..	24	W	...do....	60	15.5	.....	10,000	−	.01	.....	.....	.....	.....
211	Christiana River, at mouth		13	1.40	...do..	23	W	...do....	50	15.5	.....	3,000	+	.001	.....	.....	.....	.....
												1,600	+	.01	.....	.....	.....	.....
												2,000	+	.1	.....	.....	.....	.....

[1] From bottom.

[2] Highest dilution planted.

TABLE Q.—*Delaware River above Ready Island*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.			Dissolved oxygen, parts per million.		
											Number colonies per c. c. agar 37° 48 hours.	B. coli.	Per cent saturation.	At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°*C.*			*C. c.*				
146	Opposite New Castle channel	23	10.00	Flood.	34	N	Fair		16.1	1.0000	48	−10				
147	Opposite Pigeon Point channel	23	10.30	...do..	34	N	...do		16.1	1.0000	45	−10				
148	Opposite New Castle channel	26	8.30	...do..	33	SW	Cloudy	100	15.5	1.0000	6,000	[2]+ .1				
149	Opposite Delaware City channel, New Jersey side.	26	9.10	...do..	33	SW	...do	75	14.4	1.0015	3,930	+1				
150	Opposite Reedy Island channel, New Jersey side.	26	9.45	...do..	34	SW	...do	10	14.7	1.0025	720	+1				
151	Opposite Pigeon Point channel	Nov. 8	1.15 p. m.	...do..	33		Fair	100			3,290	+ .1				
152	Opposite New Castle channel	8	1.45	...do..	33		...do	100			2,510	+ 1				
153	Opposite Delaware City channel	8	2.15	F. last.	34		...do	75			Spr.	+ 1				
154	Opposite Reedy Island, New Jersey side.	8	2.45	E. beg.	34		...do	20			86	+10				
155	Junction of channels below Bordentown.	Dec. 4	8.30 a. m.	L. w...	16	None	...do	15	2.7		200	[2]+ .1				
156	Opposite Roebling	4	8.45	...do..	14	...do..	...do	20	2.7		115	[2]+ .1				
157	Opposite Florence	4	9.10	F. beg.	21	...do..	...do	20	2.7		53	[2]+ .1				
158	Opposite Bristol	4	9.30	Flood.	22	...do..	...do	15	2.7		73	+ 1				
159	Opposite Beverly	4	10.00	...do..	31	NW	...do	15	2.7		67	[2]+ .1				
160	Opposite Andalusia	4	10.20	...do..	14	NW	...do	10	3.7		145	[2]+ .1				
161	Torresdale, Pennsylvania side	4	10.35	...do..	13	NW	Cloudy	10	2.7		212	+ .1				
162	Torresdale channel	4	10.39	...do..	32	NW	...do	10	2.7		105	+ 1				
163	Torresdale, New Jersey side	4	10.42	...do..	18	NW	...do	25	2.7		138	+ .1				
164	Bridesburg, Pennsylvania side	4	11.15	...do..	14	NW	...do	25	2.7		325	+ .1				
165	Bridesburg channel	4	11.15	...do..	32	NW	...do	25	2.7		520	[2]+ .01				
166	Bridesburg, New Jersey side	4	11.15	...do..	30	NW	...do	25	2.7		390	+ .1				
167	Kaighn Point, New Jersey side	6	12.00 m.	...do..	33	NW	...do	35	5.5		240	+ .1				
168	Kaighn Point channel	6	12.00	...do..	32	NW	...do	35	5.5		265	+ .1				
169	Kaighn Point mid-channel	6	12.00	...do..	32	NW	...do	35	5.5		[1]285	+ .01				
170	Kaighn Point, Pennsylvania side.	6	12.00	...do..	38	NW	...do	30	5.5		385	+ .01				
171	Gloucester, New Jersey side	6	12.30 p. m.	...do..	18	NW	...do	50	5.5		150	+ .01				
172	Gloucester channel	6	12.30	...do..	44	NW	...do	50	5.5		275	+ .01				
173	.....do	6	12.30	...do..	44	NW	...do	50	5.5		[1]165	+ .01				
174	Gloucester, Pennsylvania side	6	12.30	...do..	21	NW	...do	50	5.5		185	+ .01				
175	League Island, New Jersey side	6	1.00	...do..	23	NW	...do	35	5.5		240	− .1				
176	League Island channel	6	1.00	...do..	39	NW	...do	30	5.5		315	+ .1				

177	....do		6	1.00	...do..	39	NW...	...do....	30	5.5	.....	[1] 245	+	.1	.....	.....
178	League Island, Pennsylvania side.		6	1.00	...do..	34	NW...	...do....	25	5.5	.....	255	+	.1	.....	.....
179	Mifflin Bar, New Jersey side.....		6	1.30	...do..	24	NW...	...do....	25	5.5	.....	100	+	.1	.....	.....
180	Mifflin Bar channel.....		6	1.30	...do..	36	NW...	...do....	25	5.5	.....	185	−	.1	.....	.....
181	Mifflin Bar.....		6	1.30	...do..	36	NW...	...do....	25	5.5	.....	[1] 390	+	.1	.....	.....
182	Mifflin Bar, Pennsylvania side...		6	1.30	...do..	31	NW...	...do....	30	5.5	.....	330	+	.1	.....	.....
183	Tinicum Island, New Jersey side.		6	2.00	F. last.	21	NW...	...do....	25	5.5	.....	265	+	.1	.....	.....
184	Tinicum Island channel.....		6	2.00	...do..	38	NW...	...do....	25	5.5	.....	245	−	.1	.....	.....
185	....do.....		6	2.00	...do..	38	NW...	...do....	25	5.5	.....	[1] 215	−	.1	.....	.....
186	Tinicum Island, Pennsylvania side		6	2.00	...do..	20	NW...	...do....	25	5.5	.....	165	−	.1	.....	.....
187	Marcus Hook, New Jersey side...		6	2.45	E. beg.	18	NW...	...do....	35	5.5	.....	120	+	.1	.....	.....
188	Marcus Hook channel.....		6	2.45	...do..	36	NW...	...do....	35	5.5	.....	210	−	.1	.....	.....
189	....do.....		6	2.45	...do..	36	NW...	...do....	35	5.5	.....	[1] 115	+	.1	.....	.....
190	Marcus Hook, Pennsylvania side.		6	2.45	...do..	15	NW...	...do....	40	5.5	.....	95	+	.1	.....	.....
191	Gordon Heights, Delaware side..		6	3.20	Ebb ..	28	NW...	...do....	50	5.5	.....	130	+	.1	.....	.....
192	Gordon Heights (Del.) channel...		6	3.20	...do..	35	NW...	...do....	75	5.5	.....	100	−	.1	.....	.....
193	....do.....		6	3.20	...do..	35	NW...	...do....	75	5.5	.....	[1] 110	+	.1	.....	.....
194	Gordon Heights, New Jersey side.		6	3.20	...do..	24	NW...	...do....	100	5.5	.....	245	+	.1	.....	.....
195	Pigeon Point, New Jersey side...		6	3.50	...do..	51	NW...	...do....	100	5.5	.....	180	−	.1	.....	.....
196	Pigeon Point channel.....		6	3.50	...do..	34	NW...	...do....	60	5.5	.....	[1] 135	−	.1	.....	.....
197	....do.....		6	3.50	...do..	34	NW...	...do....	60	5.5	.....	135	+	.1	.....	.....
198	Pigeon Point, Delaware side.....		6	3.50	...do..	14	NW...	...do....	75	5.5	.....	260	+	.1	.....	.....
199	Pigeon Point mid-channel.....		8	9.30 a. m.	Flood.	33	NW...	...do....	100	3.8	.....	88	+	.1	.....	.....
200	Opposite New Castle.....		8	10.00	...do..	33	NW...	...do....	100	3.8	.....	33	+	1	.....	.....
201	Opposite Delaware City, channel.		8	11.30	...do..	34	NW...	...do....	100	3.8	.....	35	+	1	.....	.....
202	Reedy Island, Delaware side.....		8	11.45	...do..	32	NW...	...do....	100	3.8	.....	48	+	1	.....	.....
203	Reedy Island channel.....		8	11.45	...do..	34	NW...	...do....	75	3.8	.....	33	[2]+	.1	.....	.....
204	....do.....		8	11.50	...do..	34	NW...	...do....	75	3.8	.....	[1] 38	+	1	.....	.....
205	Reedy Island, New Jersey side...		8	11.50	...do..	13	NW...	...do....	75	3.8	.....	33	+	1	.....	.....
206	Christiana River, bridge.....	Oct.	13	11.00	...do..	.....	W....	Fair.....	25	15.0	.....	300	+	.01	.....	.....
207	Christiana River, Delaware pulp mills.		13	11.20	...do..	.....	W.....	...do....	40	15.8	.....	4,000	−	.01	.....	.....
208	Christiana River, Harlan & Hollingsworth pulp mills.		13	11.35	...do..	.....	W.....	...do....	100	15.5	.....	10,000	−	.01	.....	.....
209	Christiana River, below Third Street Bridge.		13	1.20 p. m.	...do..	.....	W.....	...do....	100	15.5	.....	3,000	+	.001	.....	.....
210	Christiana River, mouth of Brandywine Creek.		13	1.28	...do..	24	W.....	...do....	60	15.5	.....	1,600	+	.01	.....	.....
211	Christiana River, at mouth.....		13	1.40	...do..	23	W.....	...do....	50	15.5	.....	2,000	+	.1	.....	.....

[1] From bottom.

[2] Highest dilution planted.

TABLE R.

Delaware River and Delaware Bay below Reedy Island.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water samples.	
											Number colonies per c. c., agar 37° 48 hours.	B. coli.
		1915.			*Feet.*				°*C.*			*c. c.*
1	Opposite lower end Stony Point Shoal channel, Delaware side.	Oct. 13	4.00 p. m.	Flood...	30	S.....	Cloudy..	15	16.1	1.0065	88	+ 1
2	Opposite Liston Point channel	13	4.30	...do.....	30	S.....	...do.....	5	15.9	1.0100	54	−10
3	Opposite Arnold Shoal light buoy channel	13	5.00	...do.....	30	S.....	...do	0	15.9	1.0100	38	+10
4	Opposite Ship John Light, New Jersey side	13	5.30	...do.....	16	S.....	...do.....	0	15.9	1.0115	28	−10
5	.....do	15	12.45	...do.....	19	None....	Foggy...	5	16.6	1.0110	.....	+10
6	Opposite Arnold Shoal light buoy channel	15	1.15	...do.....	30	...do.....	...do.....	5	17.2	1.0060	.....	+ 1
7	Opposite Liston Point, channel	15	1.45	...do.....	30	...do.....	...do.....	0	18.3	1.0030	.....	+10
8	Opposite lower end Stony Point Shoal channel, Delaware side.	15	2.00	...do.....	30	...do.....	Fair.....	5	18.7	1.0010	.....	+ 1
9	.....do	18	1.10	Ebb....	30	S.....	Cloudy..	20	16.6	1.0035	55	[1]+ .1
10	Opposite Liston Point channel	18	1.40	E. last..	30	S.....	...do.....	5	16.6	1.0055	120	[1]+ .1
11	Opposite Arnold Shoal light buoy channel	18	2.00	F. beg ..	30	S.....	...do.....	5	16.6	1.0055	95	+10
12	Opposite Ship John light, New Jersey side	18	2.30	...do.....	19	S.....	...do.....	0	16.6	1.0100	75	+10
13	Opposite lower end Stony Point Shoal channel, Delaware side.	22	9.00 a. m.	Flood...	30	None....	Fair.....	5	17.2	1.0050	44	+10
14	Opposite Liston Point channel	22	9.30	...do.....	30	...do.....	...do.....	5	16.9	1.0080	32	+10
15	Opposite Arnold Shoal light buoy channel	22	10.00	...do.....	30	...do.....	...do.....	5	16.9	1.0105	27	+10
16	Opposite Ship John Light, New Jersey side	22	10.45	...do.....	16	...do.....	...do.....	5	16.9	1.0115	20	+10
17	.....do	23	7.00	...do.....	18	N.....	...do.....	5	15.5	1.0100	20	−10
18	Opposite Liston Point channel	23	8.00	...do.....	30	N.....	...do.....	5	15.9	1.0060	10	−10
19	Opposite lower end Stony Point Shoal channel, Delaware side.	23	8.30	...do.....	30	N.....	...do.....	5	16.1	1.0030	44	−10
20	.....do	26	10.15	...do.....	30	S. W....	Cloudy..	5	15.0	1.0050	64	+10
21	Opposite Arnold Shoal Light buoy channel	26	11.30	...do.....	30	S. W....	...do.....	5	15.3	1.0110	32	−10
22	Opposite Ship John Light channel, Delaware side	26	12.15 p. m.	F. last ..	17	S. W....	Fair.....	0	15.5	1.0140	29	+10
23	Ben Davis Point bell buoys channel	26	12.45	E. beg ..	54	S. W....	...do.....	0	15.5	1.0150	23	−10
24	Opposite Cross Ledge Light, New Jersey side	26	1.15	Ebb.....	16	S. W....	...do	0	16.1	1.0160	12	−10
25	Opposite Miah Maull Light, New Jersey side	26	1.45	...do.....	19	S. W....	...do	0	16.4	1.0180	8	−10
26	Opposite Egg Island light house, New Jersey side	26	2.00	...do.....	10	S.....	...do	0	16.1	1.0200	15	−10
27	Opposite lower end Stony Point Shoal	Nov. 8	3.15	...do.....	30	S.....	...do.....	0	.....	.....	Spr.	+ 1
28	Opposite Liston Point	8	3.45	...do.....	30	S.....	...do.....	0	.....	.....	Spr.	+ 1
29	At Arnold Shoal light buoy	8	4.15	...do.....	30	S.....	...do.....	0	.....	.....	45	−10
30	Opposite Ship John Light, New Jersey side	8	4.45	...do.....	17	S.....	...do.....	0	.....	.....	56	−10

31	Opposite lower end Stony Point shoal channel	Dec. 8	12.45	Flood	30	N. W	Cloudy	5	5.0		34	+10
32	Opposite Liston Point channel	8	1.10	do	30	N. W	do	5	5.0		34	−10
33	Opposite Arnold Shoal buoy channel	8	5.05	Ebb	30	S. W	do	0	5.0		25	+ 1
34	Opposite Ship John Light, ½ mile to west	8	5.45	do	45	S. W	do	0	5.0		25	−10
35	Midway between Ship John and Egg Island light	8	6.30	do	23	S. W	do	0	5.0		36	−10
36	Opposite Egg Island Light	8	7.30	do	10	S. W	do	0	5.0		28	−10
37	Off mouth Maurice River	16	1.30	do	8	None	Fair	35	.5		52	+10
38	Opposite Egg Island light	16	2.00	do	10	do	do	35	.5		23	−10
39	Between Egg Island and Ship John light	16	3.00	L. W	23	do	do	35	.5		19	−10
40	Off Ship John Light, New Jersey side	16	4.00	Flood	16	do	do	37	.5		37	+10

Highest dilution planted.

TABLE S.—*Delaware Bay—Maurice River Cove.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C. c.*		
1	Section C, bed No. 136	Sept. 20	11.20 a. m.	Ebb	12	SW	Fair	30	25.5	1.0140	[1] 25	+10	7,500	0
											136	−10		
2	Section C, bed No. 131	20	11.35	do	8	SW	do	30	25.5	1.0140	[1] 30	−10	8,500	1
											28	−10		
3	Section C, bed No. 244	20	11.50	do	10	SW	do	10	25.5	1.0140	[1] 15	−10	800	0
											13	−10		
4	Section C, bed No. 196	20	12.35 p. m.	do	12	SW	do	60	25.5	1.0135	[1] 35	+ 1	600	1
											20	+10		
5	Section C, bed No. 54	20	12.50	E. Last	7	SW	do	30	25.5	1.0140	[1] 45	+10	1,200	0
											32	−10		
6	Section C, bed No. 54	20	12.50	do	7	SW	do	30	25.5	1.0140	.....	.....	6,500	2
7	Section C, bed No. 97	20	1.15	F. Beg.		SW	do	10	25.5	1.0140	[1] 70	−10	8,500	1
											15	+10		
8	Section C, bed No. 306	22	11.30 a. m.	Ebb	15	NW	do	5	20.5	1.0150	[1] 10	+ 1	50	0
											37	−10		
9	Section C, bed No. 611	22	12.00 m.	do	20	NW	do	5	21.1	1.0165	[1] 25	+10	150	0
											9	−10		
10	Section C, bed No. 605	22	12.40 p. m.	do	20	NW	do	5	21.1	1.0160	[1] 45	+10	50	1
											8	−10		
11	Section C, bed No. 439	22	1.40	do	12	NW	do	5	21.6	1.0165	[1] 44	+ 1	50	0
											4	−10		
12	Section C, bed No. 394	22	2.50	do	10	NW	do	30	21.1	1.0150	[1] 25	−10	100	0
											17	−10		
13	Section C, bed No. 367	22	3.10	do	8	NW	do	30	21.6	1.0150	[1] 38	−10	0	0
											17	−10		
14	Section B, bed No. 154	29	11.15	Flood	15	NW	do	Slight	16.3	1.0155	[1] 7	−10	20	0
											14	+10		
15	Section A, bed No. 214	29	11.35	do	12	NW	do	do	16.6	1.0150	[1] 7	−10	0	0
											11	−10		
16	Section A, near bed No. 249	29	11.50	do	12	NW	do	do	16.6	1.0150	[1] 27	−10	5	0
											26	−10		
17	Section A, near bed No. 31	29	12.05	do	12	NW	do	do	16.6	1.0150	[1] 17	−10	30	1
											16	−10		
18	Section A, near bed No. 109	29	12.25	do	12	NW	do	do	16.6	1.0150	[1] 17	−10	0	0
											8	−10		

19	Section A, near bed No. 158.....		29	12.45	F.Last	12	NW...	...do....	.....do.....	16.6	1.0150	[1] 20 8	−10 −10	5	0
20	Section A, George Robbins's bed.....		29	1.15	H.W..	12	NW...	...do....	.....do.....	16.6	1.0160	[1] 6 9	−10 −10	20	0
21	Section B, Stites's bed.....		29	1.45	E.Beg.	20	NW...	...do....	.....do.....	17.2	1.0170	[1] 8 8	−10 −10	5	0
22	Section B, near bed No. 192.....		29	2.10	Ebb..	15	NW...	...do....	.....do.....	16.3	1.0155	[1] 9 8	−10 −10	20	0
23	Section B, bed No. 106.....		29	2.35	...do..	15	NW...	...do....	.....do.....	17.2	1.0155	[1] 7 4	−10 −10	50	3
24	Section B, bed No. 58.....		29	2.55	...do..	12	NW...	...do....	.....do.....	17.2	1.0155	[1] 20 12	−10 −10	40	1
25	Section B, bed No. 20.....		29	3.15	...do..	12	N.....	...do....	.....do.....	17.2	1.0150	[1] 29 28	−10 + 1	175	1
26	Section D, bed No. 37.....	Oct.	1	9.45 a. m.	...do..	8	E.....	Stormy.	Moderate...	16.9	1.0160	[1] 18 35	+ 1 −10	300	23
27	Section D, bed No. 41.....		1	10.00	...do..	15	E.....	...do....	.....do.....	17.2	1.0160	[1] 45 38	−10 +10	400	14
28	Section D, bed No. 406.....		4	4.05 p. m.	Flood.	15	SW...	Fair....	0.....	18.3	1.0155	[1] 29 22	−10 −10	810	4
29	Section D, bed No. 442.....		4	4.25	...do..	15	SW...	...do....	0.....	18.3	1.0180	[1] 30 41	−10 +10	450	0
30	Section D, bed No. 297.....		4	4.35	...do..	15	SW...	...do....	0.....	18.3	1.0180	[1] 91 16	−10 +10	1,640	5
31	Section D, bed No. 332.....		4	4.55	...do..	15	SW...	...do....	0.....	18.3	1.0175	[1] 92 17	−10 −10	2,070	5

[1] From bottom.

TABLE S.—*Delaware Bay—Maurice River Cove.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C. c.*		
1	Section C, bed No. 136	Sept. 20	11.20 a. m.	Ebb..	12	SW...	Fair....	30.....	25.5	1.0140	1 25 136	+10 −10	7,500	0
2	Section C, bed No. 131	20	11.35	...do..	8	SW...	...do....	30.....	25.5	1.0140	1 30 28	−10 −10	8,500	1
3	Section C, bed No. 244	20	11.50	...do..	10	SW...	...do....	10.....	25.5	1.0140	1 15 13	−10 −10	800	0
4	Section C, bed No. 196	20	12.35 p. m.	...do..	12	SW...	...do....	60.....	25.5	1.0135	1 35 20	+1 +10	600	1
5	Section C, bed No. 54	20	12.50	E.Last	7	SW...	...do....	30.....	25.5	1.0140	1 45 32	+10 −10	1,200	0
6	Section C, bed No. 54	20	12.50	...do..	7	SW...	...do....	30.....	25.5	1.0140	.....	.....	6,500	2
7	Section C, bed No. 97	20	1.15	F.Beg.		SW...	...do....	10.....	25.5	1.0140	1 70 15	−10 +10	8,500	1
8	Section C, bed No. 306	22	11.30 a. m.	Ebb..	15	NW...	...do....	5.....	20.5	1.0150	1 10 37	+1 −10	50	0
9	Section C, bed No. 611	22	12.00 m.	...do..	20	NW...	...do....	5.....	21.1	1.0165	1 25 9	+10 −10	150	0
10	Section C, bed No. 605	22	12.40 p. m.	...do..	20	NW...	...do....	5.....	21.1	1.0160	1 45 8	+10 −10	50	1
11	Section C, bed No. 439	22	1.40	...do..	12	NW...	...do....	5.....	21.6	1.0165	1 44 4	+1 −10	50	0
12	Section C, bed No. 394	22	2.50	...do..	10	NW...	...do....	30.....	21.1	1.0150	1 25 17	−10 −10	100	0
13	Section C, bed No. 367	22	3.10	...do..	8	NW...	...do....	30.....	21.6	1.0150	1 38 17	−10 −10	0	0
14	Section B, bed No. 154	29	11.15	Flood.	15	NW...	...do....	Slight.....	16.3	1.0155	1 7 14	−10 +10	20	0
15	Section A, bed No. 214	29	11.35	...do..	12	NW...	...do....	.....do.....	16.6	1.0150	1 7 11	−10 −10	0	0
16	Section A, near bed No. 249	29	11.50	...do..	12	NW...	...do....	.....do.....	16.6	1.0150	1 27 26	−10 −10	5	0
17	Section A, near bed No. 31	29	12.05	...do..	12	NW...	...do....	.....do.....	16.6	1.0150	1 17 16	−10 −10	30	1
18	Section A, near bed No. 109	29	12.25	...do..	12	NW...	...do....	.....do.....	16.6	1.0150	1 17 8	−10 −10	0	0

19	Section A, near bed No. 158.....		29	12.45	F.Last	12	NW...	...do....	.....do.....	16.6	1.0150	[1] 20 8	−10 −10	5	0
20	Section A, George Robbins's bed.....		29	1.15	H.W..	12	NW...	...do....	.....do.....	16.6	1.0160	[1] 6 9	−10 −10	20	0
21	Section B, Stites's bed.....		29	1.45	E.Beg.	20	NW...	...do....	.....do.....	17.2	1.0170	[1] 8 8	−10 −10	5	0
22	Section B, near bed No. 192.....		29	2.10	Ebb..	15	NW...	...do....	.....do.....	16.3	1.0155	[1] 9 8	−10 −10	20	0
23	Section B, bed No. 106.....		29	2.35	...do..	15	NW...	...do....	.....do.....	17.2	1.0155	[1] 7 4	−10 −10	50	3
24	Section B, bed No. 58.....		29	2.55	...do..	12	NW...	...do....	.....do.....	17.2	1.0155	[1] 20 12	−10 −10	40	1
25	Section B, bed No. 20.....		29	3.15	...do..	12	N.....	...do....	.....do.....	17.2	1.0150	[1] 29 28	−10 + 1	175	1
26	Section D, bed No. 37.....	Oct.	1	9.45 a. m.	...do..	8	E.....	Stormy.	Moderate...	16.9	1.0160	[1] 18 35	+ 1 −10	300	23
27	Section D, bed No. 41.....		1	10.00	...do..	15	E.....	...do....	.....do.....	17.2	1.0160	[1] 45 38	−10 +10	490	14
28	Section D, bed No. 406.....		4	4.05 p. m.	Flood.	15	SW...	Fair....	0.....	18.3	1.0155	[1] 29 22	−10 −10	810	4
29	Section D, bed No. 442.....		4	4.25	...do..	15	SW...	...do....	0.....	18.3	1.0180	[1] 30 41	−10 +10	450	0
30	Section D, bed No. 297.....		4	4.35	...do..	15	SW...	...do....	0.....	18.3	1.0180	[1] 91 16	−10 +10	1,640	5
31	Section D, bed No. 332.....		4	4.55	...do..	15	SW...	...do....	0.....	18.3	1.0175	[1] 92 17	−10 −10	2,070	5

[1] From bottom.

TABLE T.—*Delaware Bay—Delaware Side.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Water over beds.		Shellfish.	
											Number of colonies per c. c., agar 37°, 48 hours.	B. coli.	Number of colonies per c. c., agar 37°, 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			*C. c.*		
1	Oscar Cannon's bed	Oct. 6	1.10 p. m.	Ebb	10	NE.	Cloudy	Moderate	17.2	1.0170	[1] 310 160	+10 + 1	200	1
2	Peter Paynter's bed	6	1.30	do	10	NE.	do	do	17.2	1.0170	[1] 100 60	+10 +10	100	2
3	John C. Peterson's bed	6	1.50	Flood	14	NE.	do	Slight	17.2	1.0165	[1] 30 50	−10 −10	100	2
4	Near E. Johnson's bed	6	2.30	do	14	NE.	do	do	17.2	1.0160	[1] 0 30	−10 −10	200	2
5	Wm. Shillingsburg's bed	6	2.40	do	14	NE.	do	do	17.2	1.0160	[1] 90 70	−10 −10	100	5
6	Winsmore & Walls' bed	6	3.10	do	16	NE.	do	do	17.2	1.0160	[1] 290 30	−10 −10	200	0
7	Geo. H. Woodall's bed, taken from schooner.	6	3.45	Ebb				Slight do	17.2 17.2	1.0160 1.0160	[1] 50 110	−10 −10	300	1
8	John Arnold's bed	6	4.15	Flood	16	NE.	Cloudy	do	17.2	1.0150	[1] 30 30	−10 −10	100	1
9	J. Peterson's bed	7	11.05 a. m.	Ebb	20	NE.	Rain	0	17.7	1.0175	[1] 5 17	−10 −10	200	1
10	Wm. Shillingsburg's bed	7	11.40	do	18	NE.	do	0	17.7	1.0170	[1] 11 17	+10 −10	100	1
11	Winsmore & Walls' bed, southwest corner.	7	12.00 m.	do	16	NE.	do	0	17.7	1.0170	[1] 39 Spr.	−10 −10	200	1
12	J. M. Garrison's bed	7	12.25 p. m.	do	12	NE.	do	0	17.2	1.0160	[1] 19 15	−10 −10	100	2
13	Semerteen & Lodge's bed	7	1.05	do	8	NE.	do	0	16.8	1.0160	Spr. 14	−10 −10	450	0
14	M. B. Devereux's bed	7	1.20	do	7	NE.	do	0	16.6	1.0155	[1] 72 39	−10 −10	100	1
15	Frank B. Robbins' bed	7	1.40	do	6	NE.	do	10	16.6	1.0150	[1] Spr. Spr.	−10 −10	200	0
16	John T. Buckson's bed	7	1.55	do	6	NE.	do	25	16.6	1.0145	[1] Spr. Spr.	−10 −10	500	1
17	George H. Carey's bed	7	2.15	Flood	8	NE.	do	25	16.6	1.0140	[1] 40 Spr.	−10 −10	300	2

[1] From bottom.

TABLE U.—*Analysis of Tables Q, R, S, and T.*

Name of station.	Distance from Philadelphia, Chestnut Street Wharf (nautical miles).	Number of samples.	Per cent of samples showing *B. coli* present in each dilution.						Mean number of B. coli per c. c.	Total count on agar at 37°.			Dissolved oxygen determination.						Number of dissolved oxygen samples.
			C. c. 10.	C. c. 1.	C. c. 0.1.	C. c. 0.01.	C. c. 0.001.	C. c. 0.0001.		Average.	High.	Low.	Per cent saturation.			Loss on incubation, p. p. m.			
													Average.	High.	Low.	Average.	High.	Low.	
Torresdale	8¼ above	12	.....	100	92	17	0	0	12.3	785	2,800	[1] 105	78.8	85.2	69.2	0.28	1.20	0	12
Bridesburg	4½ above	12	.....	100	92	50	8	0	31.6	6,626	40,000	[1] 325	71.8	78.2	57.1	.34	1.10	0	12
Coopers Point	0.7 above	9	.....	100	100	100	78	0	603	13,000	33,000	4,000	45.3	66.8	29.2	.60	1.40	.10	12
Kaighn Point	1½ below	13	.....	100	100	61.5	31	7.7	100	5,615	16,000	[1] 265	35.4	53.9	11.6	.43	1.10	0	12
Gloucester Point	2 below	13	.....	100	100	85	15	0	100	8,870	37,000	[1] 165	35.2	49.4	16.3	.52	.85	.20	12
League Island	5.6 below	14	.....	100	93	71.4	36	7	119	16,115	66,000	[1] 240	33.3	44.5	18.6	.38	.80	.10	12
Mifflin Bar [2]	8.3 below	17	.....	100	100	88	29.4	([3])	149	7,278	63,500	[1] 150	34.4	43.4	24.7	.42	1.00	0	12
Tinicum Island	12.5 below	17	.....	100	88.4	47	5.9	0	25.9	3,627	14,000	[1] 165	34.1	49.6	23.5	.34	.80	0	12
Marcus Hook [4]	17.7 below	17	.....	100	82.4	17.6	0	0	10	2,832	16,800	[1] 95	46.7	58.5	32.4	.29	.70	0	12
Gordon Heights [5]	22.2 below	15	.....	100	86.7	6.7	0	0	8.6	3,093	9,900	[1] 100	52.7	59.6	46.0	.29	1.05	0	12
Pigeon Point [6]	26 below	21	95	95	62	5	5	.....	4.2	6,100	59,000	45	68.0	79.5	46.0	.33	.70	0	12
Newcastle	29.7 below	9	89	78	22	0	0	.....	.78	1,420	6,000	25	.....	.....	.....	.....	.....	.....	.....
Delaware City	34 below	7	85.7	85.7	28.6	0	.....	.....	1.0	920	3,930	19	.....	.....	.....	.....	.....	.....	.....
Reedy Island	37½ below	19	94.7	84	37	0	.....	.....	1.4	1,261	24,000	12	73.7	77.9	68.3	.43	1.10	0	12
Stony Point Shoal	43 below	8	87.5	50	12.5	0	.....	.....	.32	55	88	34	.....	.....	.....	.....	.....	.....	.....
Liston Point	45.5 below	7	43	14	14	0	.....	.....	.05	48	120	10	.....	.....	.....	.....	.....	.....	.....
Arnold Shoal Light	50 below	6	83.3	33.3	0	0	.....	.....	.1	43	95	25	.....	.....	.....	.....	.....	.....	.....
Ship John Light	54.6 below	8	50	0	0	0	.....	.....	.03	36	75	20	.....	.....	.....	.....	.....	.....	.....
Delaware Bay, below Ship John Light, New Jersey side.	Below	69	23.2	7.2	0	.....	.....	.....	.02	26	136	4	.....	.....	.....	.....	.....	.....	.....
Delaware Bay, below East Line, Delaware side.	61 below and over.	34	15	3	0	.....	.....	.....	.015	64	310	5	.....	.....	.....	.....	.....	.....	.....

[1] These low results were all obtained on Dec. 4 and 6 and were uniform, the *B. coli* also giving minimum results for each station.
[2] Cross-section receives both Schuylkill and Delaware pollutions.
[3] Not used.
[4] Receives accessions from Chester and Eddystone on ebb tide.
[5] Receives flood accessions from Christiana Creek, Wilmington.
[6] Receives ebb accessions from Christiana Creek, Wilmington.

TABLE V.—*Maurice River.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.	Per cent saturation.	Parts per million.		
														At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				°*C.*			*C. c.*				
1	Dock at Millville	Sept. 2	11.40 a. m.	E. last		NE	Fair	0	21.1	1.0000	1,160	[1] + .01	84.1	7.55	7.40	.15
2	Off Millville sewage disposal plant	2	11.55	F. beg.		NE	do	0	20.5	1.0000	1,030	[1] + .01	80.2	7.20	7.10	.10
3	Off brickyard	2	12.25 p. m.	Flood		NE	do	0	20.0	1.0000	330	[1] + .1	71.9	6.60	6.55	.05
4	Mouth of Menantico Creek	2	12.35	do		NE	do	0	20.0	1.0000	390	[1] + .1	73.6	6.75	.....	.....
5	Off Bricksboro	2	1.20	do		NE	do	5	21.1	1.0000	90	[1] + .1	76.3	6.85	6.70	.15
6	Below bridge at Mauricetown	2	1.30	do		NE	do	30	21.1	1.0000	72	[1] + .1	76.3	6.85	6.85	.0
7	Off Dorchester	2	1.50	do		NE	do	40	21.1	1.0000	116	+ 1	75.8	6.80	6.75	.05
8	Off Leesburg	2	2.10	do		NE	do	30	21.1	1.0000	90	+10	74.3	6.65	6.80	+ .15
9	Off Bivalve	2	3.05	do		NE	do	10	20.0	1.0080	36	+ 1	87.9	7.65	7.70	+ .05
10	At fish-oil factory	15	4.15	Ebb		SW	do	60	26.6	.....	343	[1] + .1	101.4	8.25	5.60	2.65
11	At Bivalve	15	6.00	do		SW	do	60	26.6	.....	449	+ 1	87.9	7.15	5.80	1.35
12	At mouth	15	6.35	do		SW	do	100	26.6	.....	540	+ 1	105.1	8.55	5.70	2.85
13	Dock at Millville	16	4.05	F. last		SW	do	0	25.5	.....	270	[1] + .1	79.5	6.60	5.30	1.30
14	Below Millville sewage disposal plant outlet.	15	4.10	H.W.		SW	do	0	25.5	.....	810	[1] + .1	63.8	5.30	4.70	.60
15	Midway between Millville disposal plant and brickyard.	16	4.35	E. beg.		SW	do	0	26.6	.....	94	+ 1	75.9	6.30	5.30	1.00
16	Opposite brickyard	16	4.45	do		SW	do	0	26.6	.....	26	+ 1	81.9	6.80	6.80	.0
17	Below mouth Menantico Creek	16	4.55	do		SW	do	5	26.6	.....	80	+10	76.5	6.35	6.25	.10
18	Below mouth Manumuskin Creek	16	5.20	Ebb		SW	do	10	26.1	.....	22	+ 1	76.2	6.25	5.95	.30
19	Below bridge at Mauricetown	16	5.35	do		SW	do	10	26.1	.....	18	+ 1	77.4	6.35	5.70	.65
20	Opposite Dorchester	16	5.50	do		SW	do	10	26.1	.....	12	+ 1	70.7	5.80	5.65	.15
21	Opposite Leesburg	16	6.10	do		SW	do	20	26.1	.....	25	+ 1	71.9	5.90	5.50	.40
22	Below fish-oil factory	16	6.25	do		SW	do	40	26.1	.....	15	+10	69.5	5.70	5.60	.10
23	Bivalve, mid-channel	16	6.45	do		SW	do	50	26.1	.....	40	+ 1	75.0	6.15	5.70	.45
24	Mouth	16	7.00	do		SW	do	100	26.1	.....	0	+10	76.2	6.25	6.00	.25
25	Bivalve, at shucking house	28	1.15	E. beg.	16	None	do	10	17.2	1.0110	159	+ 1	.....	.....	.....	.....
26	do	28	1.45	Ebb	16	do	do	10	17.2	1.0110	74	+10	.....	.....	.....	.....
27	do	28	2.15	do	15	do	do	10	17.2	1.0105	65	+ 1	.....	.....	.....	.....
28	do	28	2.45	do	15	do	do	10	17.2	1.0100	165	+ 1	.....	.....	.....	.....
29	do	28	3.15	do	14	do	do	10	17.7	1.0080	33	[1] + .1	.....	.....	.....	.....
30	do	28	3.45	do	14	do	do	10	18.3	1.0070	156	+ 1	.....	.....	.....	.....
31	do	28	4.15	do	13	do	do	10	18.3	1.0055	120	+ 1	.....	.....	.....	.....
32	do	28	4.45	do	13	do	do	10	18.3	1.0040	119	[1] + .1	.....	.....	.....	.....
33	do	29	5.15	do	12	do	do	10	18.3	1.0040	196	[1] + .1	.....	.....	.....	.....

34	do		28	5.45	do	12	do	do	20	18.3	1.0025	91	+ 1					
35	do		28	6.15	do	11	do	do	30	18.3	1.0020	195	+ 1					
36	do		28	6.45	do	11	do	do	30	17.7	1.0015	12	+ 1					
37	do		28	7.15	E.last	11	do	do	30	18.3	1.0010	98	+ 1					
38	do		28	1.15	E. beg.	16	do	do	10	17.2	1.0110	[2] 99	+10					
39	do		28	1.45	Ebb	16	do	do	10	17.2	1.0110	[2] 262	+10					
40	do		28	2.15	do	15	do	do	10	17.2	1.0105	[2] 300	+ 1					
41	do		28	2.45	do	15	do	do	10	17.2	1.0100	[2] 114	+ 1					
42	do		28	3.15	do	14	do	do	10	17.7	1.0080	[2] 62	+ 1					
43	do		28	3.45	do	14	do	do	10	18.3	1.0070	[2] 125	[1] + .1					
44	do		28	4.15	do	13	do	do	10	18.3	1.0055	[2] 160	[1] + .1					
45	do		28	4.45	do	13	do	do	10	18.3	1.0040	[2] 540	+ 1					
46	do		28	5.15	do	12	do	do	10	18.3	1.0040	[2] 65	+ 1					
47	do		28	5.45	do	12	do	do	20	18.3	1.0025	[2] 58	[1] + .1					
48	do		28	6.15	do	11	do	do	30	18.3	1.0020	[2] 131	+ 1					
49	do		28	6.45	do	11	do	do	30	17.7	1.0015	[2] 150	+ 1					
50	do		28	7.15	E.last	11	do	do	30	18.3	1.0010	[2] 15	+ 1					
51	Mid-channel opposite Bivalve		30	6.45 a. m.	Ebb	11	NE	do	5	17.5	1.0030	40	+ 1					
52	do		30	7.00	do	10	NE	do	5	17.7	1.0030	110	+ 1					
53	do		30	7.15	do	10	NE	do	5	18.0	1.0025	75	+10					
54	do		30	7.30	do	10	NE	do	5	18.0	1.0025	Spr.	+ 1					
55	do		30	7.45	do	9	NE	do	5	18.0	1.0020	75	+ 1					
56	do		30	8.00	E.last	9	NE	do	5	18.0	1.0025	255	[1] + .1					
57	do		30	2.45 p. m.	E. beg	15	W	do	5	16.9	1.0115	215	+ 1					
58	do		30	3.15	Ebb	15	W	do	5	16.3	1.0110	140	+ 1					
59	do		30	3.45	do	14	W	do	5	16.6	1.0105	200	+ 1					
60	do		30	4.15	do	14	W	do	5	16.6	1.0100	130	+ 1					
61	do		30	4.45	do	13	W	do	5	16.6	1.0095	195	+10					
62	do		30	5.15	do	13	W	do	5	16.6	1.0085	140	+ 1					
63	do		30	5.45	do	12	W	do	5	16.6	1.0080	185	+10					
64	do		30	6.15	do	12	W	do	5	17.2	1.0070	120	+10					
65	do		30	6.45	do	11	W	do	10	17.2	1.0065	65	[1] + .1					
66	do		30	7.15	do	11	None	do		17.2	1.0060	145	+ 1					
67	do		30	7.45	do	10	do	do		17.2	1.0055	195	+ 1					
68	do		30	8.15	do	10	do	do		17.7	1.0050	70	[1] + .1					
69	do		30	8.45	E.last	9	do	do		17.7	1.0040	190	+ 1					
70	do	Oct.	26	3.45	Ebb	11	S	do	75	15 5	1.0050		[1] + .1					
71	do		26	4.15	do	11	S	do	75	15.5	1.0025		+ 1					
72	do		26	5.30	do	10	S	do	75	15.00	1.0015		[1] + .1					
73	do		26	6.00	do	9	S	do	50	15.05	1.0005		+ 1					
74	do		26	6.30	L. W	9	S	Cloudy	10	15.5	1.0005		+ 1					
75	Manumuskin Creek, above bridge at Port Elizabeth.		28	3.30	Ebb		None	Fair	Moderate	15.00	1.0000		+ 1					
76	do		28	3.40	do		do	do	Moderate	15.0	1.0000		[1] + .1					
77	Manumuskin Creek, midway between 76 and 78.		28	3.50	do		do	do	Moderate	15.0	1.0000		[1] + .1					
78	Manumuskin Creek at mouth		28	4.00	do		do	do	Moderate	15.0	1.0000		[1] + .1					
79	Above mouth of Manumuskin Creek.		28	4.10	do		do	do	Moderate	15.0	1.0000		+ 1					
80	do		28	4.15	do		do	do	Moderate	15.	1.0000		+ 1					

[1] Highest dilution planted.
[2] From bottom.

TABLE V.—*Maurice River*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.	Per cent saturation.	Parts per million.		
														At once.	24 hours at 20°.	Loss.
		1915.			*Feet.*				° *C.*			*C. c.*				
81	400 feet above mouth of Manumuskin Creek.	Nov. 2	1.25	Ebb...	.....	NW...	Fair...	.....	.....	.....	78	[1] + .1	.....	.....	.....	.....
82	200 feet above mouth of Manumuskin Creek.	2	1.30	...do...	.....	NW...	...do.....	.....	.....	.....	56	+ 1	.....	.....	.....	.....
83	Manumuskin Creek below Port Elizabeth.	2	1.35	...do...	.....	NW...	...do.....	.....	.....	.....	270	+ 1	.....	.....	.....	.....
84	Manumuskin Creek 2 miles above Port Elizabeth.	2	2.00	...do...	.....	NW...	...do.....	.....	.....	.....	173	+10	.....	.....	.....	.....
85	Menantico Creek above sand washer at railroad crossing.	2	4.00	(2)	2	NW...	...do.....	0	15.5	1.0000	77	+10	.....	.....	.....	.....
86	....do.....	2	4.00	(2)	2	NW...	...do.....	0	15.5	1.0000	14	+10	.....	.....	.....	.....
87	Menantico Creek below W. J. & S. R. R. bridge.	2	4.05	(2)	2	NW...	...do.....	0	15.5	1.0000	57	+10	.....	.....	.....	.....
88	Menantico Creek about 300 yards below No. 87.	2	4.10	(2)	3	NW...	...do.....	0	15.5	1.0000	86	+10	.....	.....	.....	.....
89	Manumuskin Creek 2 miles above railroad.	3	4.35	(2)	1	NW...	...do.....	0	15.0	1.0000	120	+10	.....	.....	.....	.....
90	Manumuskin Creek 1 mile above railroad.	3	4.55	(2)	1	NW...	...do.....	0	15.0	1.0000	124	+ 1	.....	.....	.....	.....
91	....do.....	3	4.55	(2)	1	NW...	...do.....	0	15.0	1.0000	112	−10	.....	.....	.....	.....
92	Manumuskin Creek at W. J. & S. bridge.	3	5.20 p. m.	Flood.	3	None..	...do.....	0	15.0	1.0000	127	+ 1	.....	.....	.....	.....
93	Gravelly Run above dam.....	4	8.30 a. m.	(2)	2	...do...	...do.....	0	14.4	1.0000	84	+10	.....	.....	.....	.....
94	....do.....	4	8.30	(2)	2	...do...	...do.....	0	14.4	1.0000	98	+10	.....	.....	.....	.....
95	....do.....	4	8.40	Ebb...	5	...do...	...do.....	5	14.4	1.0000	390	[1] + .1	.....	.....	.....	.....
96	....do.....	4	8.40	...do...	5	...do...	...do.....	5	14.4	1.0000	320	[1] + .1	.....	.....	.....	.....
97	Gravelly Run, mill race.....	4	8.45	(2)	1	...do...	...do.....	0	14.4	1.0000	62	−10	.....	.....	.....	.....
98	....do.....	4	8.45	(2)	1	...do...	...do.....	0	14.4	1.0000	114	+10	.....	.....	.....	.....
99	Below dam at Union Lake.....	4	9.30	...do...	1	...do...	...do.....	5	14.4	1.0000	Spr.	[1] + .1	.....	.....	.....	.....
100	Union Lake at spillway.....	4	9.40	(2)	.....	...do...	...do.....	0	14.4	1.0000	Spr.	..−10	.....	.....	.....	.....
101	Union Lake along dam about middle.	4	9.45	(2)	.....	...do...	...do.....	0	14.4	1.0000	43	−10	.....	.....	.....	.....
102	Union Lake near mill race.....	4	10.00	(2)	.....	...do...	...do.....	0	14.4	1.0000	51	+ 1	.....	.....	.....	.....
103	Menantico Creek, above sand washer at railroad bridge.	4	2.40 p. m.	(2)	2	S.....	Cloudy..	0	14.4	1.0000	298	+ 1	.....	.....	.....	.....

104	Menantico Creek, about 1 mile below W. J. & S. bridge.		4	3.30	Ebb...	2	S.....	...do.....	25	14.4	1.0000	270	+ 1	.....	.....	.....	.....
105	Menantico Creek at railroad bridge.		4	4.05	(2)	2	S.....	...do.....	0	14.4	1.0000	133	+ 1	.....	.....	.....	.....
106	Manumuskin Creek, 1 mile above railroad bridge.		4	5.05	(2)	1	S.....	...do.....	0	14.4	1.0000	140	[1] + .1	.....	.....	.....	.....
107	.....do.....		4	5.05	(2)	1	S.....	...do.....	0	14.4	1.0000	168	+ 1	.....	.....	.....	.....
108	Manumuskin Creek, at railroad bridge.		4	5.20	Flood.	3	S.....	Rain....	5	14.4	1.0000	300	[1] + .1	.....	.....	.....	.....
109	Dock below bridge at Millville...	Dec.	11	8.00 a. m.	Ebb...	.....	NW...	Fair.....	.....	.5	.....	40	+ 1	.....	.....	.....	.....
110	Below sewage-disposal plant.....		11	8.20	...do...	.....	NW...	...do.....	5	.5	.....	50	[1] + .01	.....	.....	.....	.....
111	Between sewage-disposal plant and brickyard.		11	8.40	...do...	.....	NW...	...do.....	5	.5	.....	130	[1] + .01	.....	.....	.....	.....
112	Brickyard.....		11	9.00	...do...	.....	NW...	...do.....	5	.5	.....	133	+ .1	.....	.....	.....	.....
113	Menantico Creek.....		11	9.20	E. last.	.....	NW...	...do.....	5	.5	.....	105	[1] + .01	.....	.....	.....	.....
114	Mouth of Manumuskin Creek.....		11	9.40	F. beg.	.....	NW...	...do.....	10	.5	.....	80	+ .1	.....	.....	.....	.....
115	Mauricetown, above bridge.....		11	10.20	Flood.	.....	NW...	...do.....	25	.5	.....	68	+ 1	.....	.....	.....	.....
116	Dorchester.....		11	10.35	...do...	.....	NW...	...do.....	25	1.1	.....	66	+ 1	.....	.....	.....	.....
117	Between Dorchester and Leesburg		11	10.45	...do...	.....	NW...	...do.....	25	1.1	.....	53	− 1	.....	.....	.....	.....
118	Leesburg.....		11	10.00	...do...	.....	NW...	...do.....	25	1.6	.....	78	+ 1	.....	.....	.....	.....
119	Fish oil factory.....		11	11.20	...do...	.....	NW...	...do.....	25	1.6	.....	86	+ 1	.....	.....	.....	.....
120	Between 119 and 121.....		11	11.40	...do...	.....	NW...	...do.....	25	1.6	.....	72	+ 1	.....	.....	.....	.....
121	Bivalve, shucking house.....		11	12.00 m.	...do...	14	NW...	...do.....	25	1.6	.....	66	+ 1	.....	.....	.....	.....
122	.....do.....		13	7.30 a. m.	Ebb...	16	NE...	Stormy..	40	2.7	.....	38	+ 1	.....	.....	.....	.....
123	.....do.....		13	8.00	...do...	15	NE...	...do.....	30	2.7	.....	130	+ .1	.....	.....	.....	.....
124	.....do.....		13	8.30	...do...	15	NE...	...do.....	25	2.7	.....	95	+ 1	.....	.....	.....	.....
125	.....do.....		13	9.00	...do...	14	NE...	...do.....	25	2.7	.....	138	− 1	.....	.....	.....	.....
126	.....do.....		13	9.30	...do...	14	NE...	...do.....	25	2.7	.....	158	+ 1	.....	.....	.....	.....
127	.....do.....		13	10.00	...do...	13	NE...	...do.....	25	2.7	.....	163	− 1	.....	.....	.....	.....
128	.....do.....		13	10.30	...do...	13	NE...	...do.....	25	2.7	.....	200	− 1	.....	.....	.....	.....
129	.....do.....		13	11.30	L. W..	11	NE...	...do.....	25	2.7	.....	188	+ 1	.....	.....	.....	.....
130	.....do.....		13	1.30 p. m.	Flood.	12	.....	...do.....	40	2.7	.....	95	− 1	.....	.....	.....	.....
131	.....do.....		13	2.30	...do...	13	NE...	...do.....	40	2.7	.....	115	+ 1	.....	.....	.....	.....
132	.....do.....		13	3.30	...do...	14	NE...	...do.....	50	2.7	.....	80	+ .1	.....	.....	.....	.....
133	.....do.....		14	6.30	Ebb...	16	NW...	Cloudy..	15	1.6	.....	110	+10	.....	.....	.....	.....
134	.....do.....		14	7.00	...do...	16	NW...	...do.....	25	1.6	.....	92	+10	.....	.....	.....	.....
135	.....do.....		14	7.30	...do...	15	NW...	...do.....	25	1.6	.....	77	+ 1	.....	.....	.....	.....
136	.....do.....		14	8.00	...do...	15	NW...	...do.....	20	1.6	.....	110	+10	.....	.....	.....	.....
137	.....do.....		14	8.30 a. m.	...do...	14	NW...	...do.....	20	1.6	.....	126	[1] + .1	.....	.....	.....	.....
138	.....do.....		14	9.00	...do...	14	NW...	...do.....	35	1.6	.....	171	[1] + .1	.....	.....	.....	.....
139	.....do.....		14	9.30	...do...	13	NW...	...do.....	25	1.6	.....	149	+10	.....	.....	.....	.....
140	.....do.....		14	10.00	...do...	13	NW...	...do.....	25	1.6	.....	170	+10	.....	.....	.....	.....
141	.....do.....		14	10.30	...do...	12	NW...	...do.....	20	1.6	.....	210	+10	.....	.....	.....	.....
142	.....do.....		14	11.00	...do...	12	NW...	...do.....	20	1.6	.....	181	+ 1	.....	.....	.....	.....
143	.....do.....		14	11.30	E. last.	11	NW...	...do.....	20	1.6	.....	190	+10	.....	.....	.....	.....
144	.....do.....		14	12.30 p. m.	F. beg.	11	NW...	...do.....	25	1.6	.....	203	−10	.....	.....	.....	.....
145	.....do.....		14	1.30	Flood.	12	NW...	...do.....	30	1.6	.....	172	+10	.....	.....	.....	.....
146	.....do.....		14	2.30	...do...	13	NW...	...do.....	30	1.6	.....	120	+ 1	.....	.....	.....	.....
147	.....do.....		16	7.00 a. m.	Ebb...	16	None..	Fair.....	35	.05	.....	110	+10	.....	.....	.....	.....
148	.....do.....		16	7.30	...do...	16	...do...	...do.....	35	.05	.....	35	+10	.....	.....	.....	.....
149	.....do.....		16	8.00	...do...	15	...do...	...do.....	35	.05	.....	131	−10	.....	.....	.....	.....

[2] Above tidewater.

[1] Highest dilution planted.

TABLE V.—*Maurice River*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth of water.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
											Number colonies per c. c., agar 37°, 48 hours.	B. coli.	Per cent saturation.	Parts per million.		
														At once. MeMM	24 hours at 20°.	Loss.
		1915.			*Feet.*				° *C.*			*C. c.*				
150	Bivalve,s hucking house	Dec. 16	8.30	Ebb	15	None	Fair	35	.05		96	+ 1				
151	do	16	9.00	do	14	do	do	35	.05		76	+10				
152	do	16	9.30	do	14	do	do	35	.05		62	−10				
153	do	16	10.00	do	13	do	do	35	.05		74	+ 1				
154	do	16	10.30	do	13	do	do	35	.05		156	+10				
155	do	16	11.00	do	12	do	do	35	.05		110	+10				
156	do	16	11.30	do	12	do	do	35	.05		130	+10				
157	Midway between Bivalve and mouth.	16	1.00 p. m.	do	19	do	do	35	1.1		76	+10				

TABLE W.—*Maurice River: Summary of results obtained from three series of samples from Millville to mouth of river.*

Name of station.	Distance from Millville.	Number samples.	Per cent of samples showing B. coli present in each dilution.					Mean number of B. coli per c.c.	Total count on agar at 37° C.			Dissolved oxygen determinations.						
			C.c. 10.	C.c. 1.	C.c. 0.1.	C.c. .01.	C.c. .001.		Average.	High.	Low.	Number of samples.	Per cent saturation.			Loss on incubation p. p. m.		
													Average.	High.	Low.	Average.	High	Low.
	Nautical miles.																	
Millville Dock	0	3	100	100	67	33	0	10.0	490	1,160	40	7	80.9	84.8	76.3	0.52	1.30	0.10
Millville sewage disposal plant	0.75	3	100	100	100	67	0	46.8	630	1,030	50	5	73.8	78.6	63.8	.60	.60	.60
Between disposal plant and brickyard	2.25	2	100	100	50	50	0	10.0	112	130	94	5	79.1	81.7	75.9	1.00	1.00	1.00
Off brickyard	3.50	3	100	100	67	0	0	4.7	163	330	26	6	78.4	81.9	71.9	.02	.05	.00
Mouth of Menantico Creek	5.25	3	100	67	67	33	0	4.7	192	390	80	2	75.1	76.5	73.6	.10	.10	.10
Manamuskin Creek	8.75	5	100	100	40	0	0	2.5	51	80	22	5	76.7	78.0	75.2	.30	.30	.30
Bricksboro	9.75	1	100	100	100	0	0	10.0	90	90	90	5	76.0	77.0	74.9	.15	.15	.15
Below bridge at Mauricetown	11.00	3	100	100	33	0	0	2.1	53	72	18	5	76.1	77.6	73.5	.32	.65	.00
Dorchester	12.00	3	100	100	0	0	0	1.0	65	116	12	5	75.2	77.6	70.7	.10	.15	.05
Leesburg	14.00	3	100	67	0	0	0	.47	64	90	25	5	75.0	77.3	71.9	.12	.40	+ .15
Menhaden fish, oil factory	15.00	3	100	67	33	0	0	1.0	175	449	36	5	79.2	101.4	69.5	1.37	2.65	+ .10
Bivalve	17.00	3	100	100	20	0	0	1.0	205	540	36	6	79.8	87.9	74.9	.87	1.35	+ .05
Mouth of Maurice River	20.00	3	100	33	0	0	0	.2	270	540	0	5	82.8	105.1	76.2	1.55	2.85	.25

TABLE X.—*Samples of "floated" oysters, Maurice River, at Bivalve and Maurice River.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Number colonies per c. c. on agar 37° 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			
1	Float of A. D. Campbell	Sept. 2	4.00 p. m.	Flood	13	None	Fair		20.0	1.0080	5,500	1
2	Float of Covert & Lee	2	4.05	do	13	do	do		20.0	1.0080	2,100	1
3	Float of Bateman & Blizzard	2	4.10	do	13	do	do		20.0	1.0080	2,600	2
4	Float of Berry & Hiles	2	4.15	do	13	do	do		20.0	1.0080	6,400	2
5	John Gaskins shipping house	16	10.00 a. m.								4,250	5
6	Mulford & Mulford shipping house	16	10.00								16,500	4
7	Morris & Fowler shipping house	16	10.00								1,450	0
8	A. D. Campbell	16	10.00								350	1
9	Sheppard Campbell shipping house	16	10.00								4,600	4
10	R. L. Bateman & Sons shipping house	16	10.00								6,900	41
11	Luther Bateman shipping house	16	10.00								5,500	3
12	C. W. Hand shipping house	16	10.00								22,350	23
13	do	17	11.00								123,000	5
14	Berry & Hiles shipping house	17	11.00								24,300	1
15	Mulford & Mulford shipping house	17	11.00								29,400	2
16	do	17	11.00								26,700	1
17	T. A. Rogers shipping house	17	11.00								33,000	23
18	Newcomb Bros. shipping house	17	11.00								285,000	3
19	Bateman & Blizzard shipping house	17	11.00								23,400	0
20	P. Campbell shipping house	17	11.00								84,000	32
21	Floated one "low water" bivalve side	21	7.00 a. m.	F. last	14	SW	Rain				63,000	32
22	do	21	7.00	do	14	SW	do				45,000	5
23	do	21	7.00	do	14	SW	do				105,000	5
24	do	21	7.00	do	14	SW	do				138,000	3
25	do	21	7.00	do	14	SW	do				13,000	23
26	do	21	7.00	do	14	SW	do				51,000	5
27	Floated 3 "low water" bivalve side	22	9.00	do	14	NW	Fair				100	5
28	do	22	9.00	do	14	NW	do				0	2
29	do	22	9.00	do	14	NW	do				200	2
30	do	22	9.00	do	14	NW	do				150	3
31	do	22	9.00	do	14	NW	do				100	0
32	do	22	9.00	do	14	NW	do				150	0
33	Floated 1 "low water" Bivalve side	23	8.30	do	14	None	do				2,450	5
34	do	23	8.30	do	14	do	do				8,650	41
35	do	23	8.30	do	14	do	do				4,700	4
36	do	23	8.30	do	14	do	do				8,350	41
37	do	23	8.30	do	14	do	do				2,050	2
38	do	23	8.30	do	14	do	do				6,150	5
39	Floated 2 "low water" Bivalve side	23	4.30 p. m.	F. beg.	9	do	do				78,000	1
40	do	23	4.30	do	9	do	do				60,000	1

41	....do		23	4.30	...do		9	...do	...do				186,000	23
42	....do		23	4.30	...do		9	...do	...do				57,000	3
43	....do		23	4.30	...do		9	...do	...do				42,000	1
44	....do		23	4.30	...do		9	...do	...do				48,000	2
45	....do		30	10.00 a. m.	...do		9	NE	...do				6,000	1
46	....do		30	10.00	...do		9	NE	...do				5,900	0
47	....do		30	10.00	...do		9	NE	...do				1,295	1
48	....do		30	10.00	...do		9	NE	...do				4,200	2
49	....do		30	10.00	...do		9	NE	...do				4,500	0
50	....do		30	10.00	...do		9	NE	...do				3,950	4
51	....do		30	10.00	...do		9	NE	...do				12,500	0
52	....do		30	10.00	...do		9	NE	...do				18,000	3
53	....do		30	10.00	...do		9	NE	...do				4,400	5
54	....do		30	10.00 a. m.	...do		9	NE	...do				4,800	1
55	....do		30	10.00	...do		9	NE	...do				1,350	14
56	John Gaskin's shipping house	Oct.	1	10.30				NE					400	23
57	Sheppard Campbell shipping house		1	10.30				NE					300	4
58	Luther Bateman shipping house		1	10.30				NE					400	32
59	P. Campbell shipping house		1	10.30				NE					300	23
60	Ogden Candy shipping house		1	10.30				NE					1,400	41
61	....do		1	10.30				NE					1,500	4
62	Hageman & Pole shipping house		1	10.30				NE					800	5
63	T. A. Rogers shipping house		1	10.30				NE					300	4
64	Float at Bivalve [1]		4	11.30	L. W.		13	SE	Fair				19,500	23
65	....do		4	11.30	...do		13	SE	...do				19,500	23
66	....do		4	11.30	...do		13	SE	...do				22,500	41
67	....do		4	11.30	...do		13	SE	...do				19,500	32
68	....do		4	11.30	...do		13	SE	...do				14,900	320
69	....do		4	11.30	...do		13	SE	...do				10,500	320
70	Sockwell shipping house [2]	Nov.	9	11.30									45,300	5
71	....do		9	11.30									27,600	32
72	....do		9	11.30									51,900	32
73	....do		9	11.30									35,700	4
74	....do		9	11.30									23,400	4
75	Oyster barge, floated 4 days	Dec.	9	2.00 p. m.									370	[3] 0
76	....do		9	2.00									1,520	[3] 0
77	Oyster barge, floated 3 or 4 days		9	2.00									700	[3] 1
78	....do		9	2.00									440	[3] 0
79	Oyster barge, floated 4 days		9	2.00									110	[3] 1
80	Oyster barge, floated 3 or 4 days		9	2.00									350	[3] 0
81	....do		9	2.00									825	[3] 3
82	Oyster barge, floated 3 days		13	10.00 a. m.									315	[3] 0
83	Oyster barge, floated 4 days		13	10.10									450	[3] 1
84	Oyster barge, floated 3 or 4 days		13	10.00									715	[3] 5
85	....do		13	10.00									2,600	[3] 1
86	....do		13	10.10									1,040	[3] 1
87	....do		13	10.10									460	[3] 2
88	....do		13	10.00									6,000	[3] 0

[1] A few scattered oysters lying in empty float. Length of time floated not known.
[2] Samples taken from shipment of oysters ready to be sent to New York City.
[3] Weather cold. Temperature of water low.

TABLE X.—*Samples of "floated" oysters, Maurice River, at Bivalve and Maurice River*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Depth.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Number colonies per c. c. on agar 37° 48 hours.	Score based on B. coli in shell liquor.
		1915.			*Feet.*				°*C.*			
89	....do	13	10.00								1,275	1 1
90	....do	13	10.00								2,400	1 0
91	....do	13	10.00								1,280	1 0
92	....do	16	11.00								380	1 1
93	....do	16	11.00								2,500	1 1
94	....do	16	11.00								270	1 1
95	....do	16	11.00								280	1 2
96	....do	16	11.00								90	1 0

[1] Weather cold. Temperature of water low.

TABLE Y.—*Cohansey River.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
										Number colonies per c. c. agar 37° 48 hours.	B. coli.	Per cent saturation.	Parts per million.		Loss.
													At once.	24 hours at 20°.	
		1915.						° C.			C. c.				
1a	Greenwich Pier	Oct. 5	2.00 p. m.	L. W.	None	Fair				175	[1] + 0.1				
1	do	14	8.00 a. m.	Ebb	E	Cloudy	5	16.6	1.0080	570	+ 1	106.7	9.90	10.00	+0.10
2	Laning Wharf	14	8.30	do	E	do	5	17.2	1.0070	670	[1] + .1	105.2	9.70	9.80	+ .05
3	Fourth reach above Laning Wharf	14	9.00	E. last	E	do	5	16.6	1.0065	Spr.	[1] + .1	105.0	9.85	9.40	.45
4	Opposite residence of John Wetherell	14	9.30	F. beg	E	do	5	16.6	1.0060	475	[1] + .1	103.0	9.70	7.75	1.95
5	Third reach above Wetherell's	14	10.00	Flood	E	do	5	16.1	1.0050	430	+ 1	102.8	9.85	8.00	1.85
6	Opposite island below Fairton	14	10.30	do	E	do	50	16.6	1.0025	900	[1] + .1	104.3	10.10	7.95	2.15
7	Fairton	14	11.00	do	E	do	50	16.6	1.0000	Spr.	[1] + .1	96.1	9.45	7.65	1.80
8	Lower end of Bridgeton	14	11.30	do	E	do		16.6	1.0000	1,220	[1] + .1	83.5	6.25	4.15	2.10
9	Between lower and middle bridges, Bridgeton.	14	12.30 p. m.	do	E	do		17.7	1.0000	18,300	[1] + .1	75.0	7.20	.55	6.65
10	Above Bridgeton	14	12.00 m.	do	E	do		17.7	1.0000	1,025	[1] + .1	98.4	9.45	7.40	2.05
11	Greenwich Pier	14	8.45 a. m.	Ebb	SE	Fair	15	17.7	1.0000	810	+ 1				
12	do	15	8.00	do	None	Foggy	30	16.9	1.0040	140	+ 1				
13	do	15	8.20	do	do	do	30	16.9	1.0025	125	+ 1				
14	do	15	9.00	do	do	do	30	17.7	1.0025	150	+ 1				
15	do	15	9.30	E. last	do	Cloudy	30	17.2	1.0020	210	+10				
16	do	15	10.00	L. W	do	do	30	16.9	1.0020	140	+ 1				
17	Halfway between mouth and Greenwich Pier.	15	11.50	Flood	do	do	5	16.6	1.0060	105	+10	109.9	10.35		
18	Mouth	15	12.15 p. m.	do	do	do	5	16.6	1.0100	55	[1] + .1	122.9	11.15		
19	Greenwich Pier	19	8.00 a. m.	F. beg	S	Fair	10	16.9	1.0100	75	+ 1				
20	do	19	8.30	Ebb	S	do	10	16.6	1.0095	60	+ 1				
21	do	19	9.00	do	S	do	10	16.9	1.0090	60	+ 1				
22	do	19	9.30	do	S	do	5	16.6	1.0085	75	+ 1				
23	do	19	10.00	do	S	do	20	17.2	1.0080	135	+ 1				
24	do	19	10.30	do	S	do	30	17.2	1.0075	120	+ 1				
25	do	19	11.00	do	S	do	20	17.2	1.0055	30	[1] + .1				
26	do	19	11.30	do	S	do	30	17.2	1.0050	150	+ 1				
27	do	19	12.00 m.	do	S	do	5	17.2	1.0040	230	[1] + .1				
28	do	19	12.30	do	S	do	5	17.2	1.0040	210	[1] + .1				

[1] Highest dilution planted.

TABLE Y.—*Cohansey River*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Wind.	Weather.	Turbidity.	Temperature.	Salinometer reading.	Bacteria in water.		Dissolved oxygen.			
										Number colonies per c. c. agar 37° 48 hours.	B. coli.	Parts per million. Per cent saturation.	At once.	24 hours at 20°.	Loss.
								° C.			C. c.				
29	Greenwich Pier	19	1.00 p. m.	Ebb	S	Fair	5	17.7	1.0035	185	[1]+ .1				
30	do	19	1.30	do	S	do	5	17.7	1.0025	440	+ 1				
31	do	19	2.00	do	S	do	5	17.7	1.0020	250	[1]+ .1				
32	do	19	2.30	L. W.	S	do	5	17.7	1.0030	310	+ 1				
32b	do	23	6.00 a. m.	F. beg.	N	do				85	−10				
33	Above railroad bridge, Bridgeton	Nov. 9	2.45 p. m.	Ebb	NW	do				2,140	[1]+ .01				
34	Between two lower bridges at Bridgeton.	9	3.05	do	NW	do				1,890	[1]+ .01				
35	Lower end of Bridgeton	9	3.15	do	NW	do				620	+ .1				
36	Opposite Fairton	9	3.30	do	NW	do				360	+ .1				
37	Island below Fairton	9	3.45	do	NW	do				420	+ .1				
38	Third reach above Wetherell's	9	4.00	do	NW	do				210	[1]+ .01				
39	Opposite John Wetherell's residence	9	4.15	do	NW	do				420	+ .1				
40	Fourth ranch above Laning Wharf	9	4.30	do	NW	do				300	+ 1				
41	Laning Wharf	9	4.45	do	NW	do				450	+ 1				
42	Greenwich Pier	9	5.00	do	NW	do				480	+ .1				
43	Fourth reach above Laning Wharf	Dec. 20	1.40 p. m.	do	N	Cloudy	15	1.1		80	− 1				
44	Third reach above Wetherell's	20	2.00	do	N	do	20	1.1		150	+ 1				
45	Island below Fairton	20	2.30	do	N	do	15	1.1		180	+ 1				
46	Below Fairton	20	2.55	do	N	do	15	1.1		500	+ .1				
47	Three miles below Bridgeton	20	3.10	do	N	do	15	1.1		450	[1]+ .01				
48	One mile below Bridgeton	20	3.20	do	N	do	5	1.1		470	+ .001				
49	Opposite gas plant at Bridgeton	20	3.25	do	N	do	5	1.6		415	+ .01				
50	Lower bridge, Bridgeton	20	3.30	do	N	do	5	1.6		425	+ .001				
51	Greenwich Pier	17	11.30 a. m.	do	N	do		.05		53	+10				
52	do	17	12.00	do	N	do		.05		65	−10				
53	do	17	12.30	do	N	do		.05		82	+10				
54	do	17	1.00 p. m.	do	N	do		.05		100	+10				
55	do	17	1.30	do	N	do		.05		68	+10				
56	do	17	2.00	do	N	do		.05		64	+10				
57	do	17	2.30	L. W.	N	do		.05		82	+10				

[1] Highest dilution planted.

TABLE Z.—*Samples of "floated" oysters, Cohansey River.*

No.	Location of sampling station.	Date.	Hour.	Tide.	Wind.	Weather.	Turbidity.	Temperature.	Number of colonies per c. c. on agar 37° 48 hours.	Score based in *B. coli* on shell liquor.
		1915						°C.		
1	Float at Greenwich Pier	Oct. 5	2.00 p. m.	E. Last.	None	Fair			0	2
2	....do	5	2.00	...do	...do	...do			100	3
3	....do	5	2.00	...do	...do	...do			100	41
4	....do	5	2.00	...do	...do	...do			250	2
5	Float of William Shillingsburg	14	9.00 a. m.	L. W	E	...do	5	16.6	90,000	410
6	Float of P. W. Williams	14	9.05	...do	E	...do	5	16.6	72,000	3
7	Float of Chris. Johnson	14	9.10	...do	E	...do	5	16.6	80,000	5
8	Float of Thomas Cooney	14	9.25	...do	E	...do	5	16.6	9,650	4
9	Float of Chris. Johnson	14	9.30	...do	E	...do	5	16.6	8,200	3
10	Float of William P. Williams	14	10.00	F. beg.	E	...do	5	16.6	9,450	5
11	....do	14	10.05	Flood	E	...do	5	16.6	4,100	3
12	....do	14	10.10	...do	E	...do	5	16.6	7,750	32
13	Float of William Shillingsburg	14	10.15	...do	E	...do	5	16.6	6,100	14
14	....do	14	10.20	...do	E	...do	5	16.6	4,800	23
15	....do	15	10.30	L. W	None	Cloudy	30	17.3	200	14
16	Float of Chris. Johnson	15	10.35	...do	...do	...do	30	17.3	5,700	32
17	....do	15	10.38	...do	...do	...do	30	17.3	12,650	5
18	Float of William P. Williams	15	10.40	...do	...do	...do	30	17.3	9,100	3
19	....do	15	10.45	...do	...do	...do	30	17.3	4,100	4
20	....do	15	10.50	...do	...do	...do	30	17.3	57,000	5
21	Float of William Shillingsburg	19	2.30 p. m.	...do	S	Fair	5	17.7	400	23
22	....do	19	2.30	...do	S	...do	5	17.7	2,100	5
23	....do	19	2.30	...do	S	...do	5	17.7	800	4
24	....do	19	2.30	...do	S	...do	5	17.7	2,900	2
25	Lower floats at Greenwich	19	2.30	...do	S	...do	5	17.7	400	0
26	....do	19	2.30	...do	S	...do	5	17.7	710	2
27	....do	19	2.30	...do	S	...do	5	17.7	910	1
28	....do	19	2.30	...do	S	...do	5	17.7	Spr.	1
29	....do	19	2.30	...do	S	...do	5	17.7	1,420	1
30	....do	19	2.30	...do	S	...do	5	17.7	1,190	5
31	Float of William Shillingsburg[1]	23	6.00 a. m.	F. beg.	N	...do				3
32	....do.[1]	23	6.00	...do	N	...do				14
33	....do.[1]	23	6.00	...do	N	...do				5
34	....do.[1]	23	6.00	...do	N	...do				4
35	....do.[1]	23	6.00	...do	N	...do				23
36	....do.[1]	23	6.00	...do	N	...do				41
37	....do.[1]	23	6.00	...do	N	...do				23

[1] From scow load taken up about 12 hours previous to time of collection of samples.

TABLE Z.—*Samples of "floating" oysters, Cohansey River*—Continued.

No.	Location of sampling station.	Date.	Hour.	Tide.	Wind.	Weather.	Turbidity.	Temperature.	Number of colonies per c. c. on agar 37° 48 hours.	Score based on *B. coli* in shell liquor.
		1915						°C.		
38	Lower floats at Greenwich[1]	Oct. 23	6.00	F. beg.	N	Fair				14
39	....do.[1]	23	6.00	...do...	N	...do...				5
40	....do.[1]	23	6.00	...do...	N	...do...				4
41	Float of William Shillingsburg	Dec. 17	10.00	L. W....	N.....	Cloudy[2]		0	110	3
42	.....do	17	10.00	...do...	N	...do...		0	80	3
43	.....do	17	10,00	...do...	N	...do...		0	100	0
44	.....do	17	10.00	...do...	N	...do...		0	90	1
45	.....do	17	10.00	...do...	N	...do...		0	390	320
46	.....do	17	10.00	...do...	N	...do...		0	205	14
47	.....do	17	10.00	...do...	N	...do...		0	330	5
48	.....do	17	10.00	...do...	N	...do...		0	245	3
49	.....do	17	10.00	...do...	N	...do...		0	210	0
50	.....do	17	10.00	...do...	N	...do...		0	190	5
51	.....do	20	7.00 p. m.	Flood...	N	...do...		1.1	560	5
52	.....do	20	7.00	...do...	N	...do...		1.1	600	4
53	.....do	20	7.00	...do...	N	...do...		1.1	490	3
54	.....do	20	7.00	...do...	N	...do...		1.1	420	0
55	.....do	20	7.00	...do...	N	...do...		1.1	1,080	0
56	.....do	20	7.00	...do...	N	...do...		1.1	200	0
57	.....do	20	7.00	...do...	N	...do...		1.1	640	2

[1] From scow load taken up about 12 hours previous to time of collection of samples.

[2] Very cold; temperature of water 0 to 3° C. most of time.

APPENDIX II.

Record of typhoid fever cases on watershed of area investigated.

RARITAN RIVEA AREA.

NEW BRUNSWICK.

[Population, 1910, 22,398.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1905	2	1	.....	4	6	6	5	2	.....	.....	3	2	31
1906	1	.....	.....	.....	.....	1	1	2	4	2	.....	2	13
1907	.....	.....	.....	.....	.....	2	.....	5	13	7	2	4	33
1908	.....	.....	4	4	2	.....	9	3	8	2	1	.....	33
1909	.....	1	1	.....	.....	3	2	9	5	5	.....	1	27
1910	1	.....	2	.....	.....	2	2	4	3	.....	3	1	18
1911	.....	5	.....	.....	.....	.....	2	.....	.....	4	1	.....	12
1912	.....	.....	.....	1	1	.....	1	3	1	6	.....	.....	13
1913	5	.....	.....	.....	.....	.....	1	3	.....	2	2	1	14
1914	.....	.....	.....	.....	.....	.....	2	1	9	2	.....	2	16

PERTH AMBOY.

[Population, 1910, 32,425.]

1907	.....	.....	1	.....	1	.....	14	24	7	5	3	.....	55
1908	.....	.....	1	.....	.....	.....	.....	1	2	.....	1	.....	5
1909	.....	.....	.....	.....	.....	.....	.....	4	5	6	.....	.....	15
1910	.....	.....	1	.....	5	1	1	4	13	20	10	8	63
1911	1	1	.....	.....	.....	3	1	9	5	4	5	3	32
1912	.....	1	.....	.....	2	1	2	5	3	4	7	2	27
1913	.....	.....	.....	.....	.....	1	3	2	60	24	7	1	98
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	16	2	5	23

SOUTH AMBOY.

[Population, 1910, 6,943.]

1910	.....	.....	.....	.....	.....	.....	.....	.....	.....	3	.....	.....	3
1911	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	.....	1
1912	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
1913	.....	.....	.....	1	.....	.....	.....	1	.....	.....	1	.....	3
1914	.....	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	1

BOROUGH OF SOUTH RIVER.[1]

[Population, 1910, 4,772.]

1907	.....	.....	.....	.....	.....	.....	3	.....	1	.....	.....	.....	4
1908	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	None.
1909	.....	.....	.....	.....	.....	.....	.....	.....	1	.....	.....	.....	1
1910	.....	3	.....	.....	.....	.....	1	4	.....	.....	.....	.....	8
1911	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	None.
1912	.....	.....	.....	.....	.....	.....	1	3	8	6	.....	.....	18
1913–14	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	None.

[1] Other cases in this area were recorded as follows:
Highland Park Borough: 1910. 1 case, November. 1911. 1 case, March. 1912. 1 case, March. 1913. No cases. 1914. No cases.
Metuchen Borough: 1910. No data. 1911. No cases. 1912. 1 case, May. 1913. 1 case, October. 1914. 1 case, January.
Raritan Township (Middlesex County): 1910. No data. 1911. 2 cases, September. 1912. 2 cases, March. 1913. 1 case, January. 1914. 1 case, December.
Sayreville Township: 1910. 1 case, September; 1 case, October; 1 case, November. 1911. No cases. 1912. 1 case, August; 1 case, October. 1913. 1 case October. 1914. No cases.

Record of typhoid fever cases on watershed of area investigated—Continued.

ARTHUR KILL AREA.

RAHWAY.

[Population, 1910, 6,367.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1906					25	1	1	1	3	4			35
1907	1		1	1	3					1			7
1908				2				4	4	1			11
1909		1	2	5	2	1						1	12
1910		11	4	1	4				1	2	1		24
1911	1		1				3					4	9
1912	4		2	3			3		1	1		1	15
1913						1		7	2				10
1914					1			1				1	3

SUMMIT.

[Population, 1910, 7,500.]

1905							1	1			3	1	6
1906	1					2	1	5	1				10
1907								1	1	2		1	5
1908	1	1	1		1							2	6
1909	4	1					1	1					7
1910							1		7		1	5	14
1911	1							3				1	5
1912	1			3									4
1913						1		1	2		2		6
1914	5	3		1					1	2			12

ELIZABETH.

[Population, 1910, 73,858.]

1905		1		1			2	9	1	5	4	2	25
1906	4		1	1	1	3	1	3	4	3	2	4	27
1907	2	1		2	3	1		2	3	3	5	1	23
1908	1	2	2	5		2	13	11	3	2		2	43
1909	4	3	9	4	2	2	2	6	5	3	3	2	36
1910	1	2	3	2	1	3	1	5	24	2	7	3	54
1911	3	2	3	4	1	1	2	2	4	3	4	3	37
1912	3	2	3	2	1	2	3	13	5	7	5	3	54
1913	6	1	2	1	2		4	7	3	7	1	2	41
1914	3	5	1		1	1	2	3	2	2	1	6	27

ROSELLE PARK.

[Population, 1910, 1,246.]

1905						1							1
1906													None.
1907								1					1
1908												1	1
1909–10													None.
1911											1		1
1912													None.
1913	1												1
1914									1				1

IRVINGTON.[1]

[Population, 1910, 12,017.]

1911			1										1
1912					1								1
1913				1					4	1	2		8
1914									1				1

[1] In the township of Woodbridge there were 7 cases of typhoid fever in 1914—3 cases in August, 1 in September, 2 in October, and 1 in December.

Record of typhoid fever cases on watershed of area investigated—Continued.

ARTHUR KILL AREA—Continued.

TOWNSHIP OF SOUTH ORANGE.

[Population, 1910, 2,979.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1905													None.
1906							3	3					6
1907								2				1	3
1908												1	1
1909											1		1
1910	1		1		1		2	6	1				12
1911		1					1		1	1		1	5
1912	2								1			1	4
1913				1					1				2
1914							1		1				2

WEST ORANGE.

[Population, 1910, 10,980.]

1905					1					1		1	3
1906			1			1	1	1	1	1			6
1907							1	1			1	1	4
1908					1	1							2
1909						3		1	1			1	6
1910							1	1			1		3
1911						2		1	4			1	8
1912								2		7	2		11
1913								1					1
1914			1	1	1			1	3	1			8

TOWNSHIP OF CRANFORD.

[Population, 1910, 3,641.]

1906					1					1		1	2
1907				1									2
1908							2				2		4
1909				3	11				1	1			16
1910							1		1				2
1911	1				1			1					3
1912					1				1	1			3
1913	1						1						2
1914													None

BOROUGH OF ROOSEVELT.

[Population, 1910, 5,786.]

1907										4			4
1908–11													None.
1912									2				2
1913			2	1		1			1	2			7
1914				1				1					2

VILLAGE OF SOUTH ORANGE.

[Population, 1910, 6,014.]

1905	2		1	2				1		1	4	4	15
1906		1		1			5	9	2	2	1		21
1907	1							1	1	2	1		6
1908									2	5	2		9
1909				1	1	1			2	2		1	8
1910			1				1	3	1		6	2	14
1911	1	2		2	2	1	1		1			3	13
1912								2	8				10
1913	1									1			2
1914										1			1

Record of typhoid fever cases on watershed of area investigated—Continued.

ARTHUR KILL AREA—Continued.

TOWNSHIP OF LINDEN.

[Population, 1910, 1,988.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1910-11													None.
1912								1					1
1913		3								2			5
1914													None.

WESTFIELD.

[Population, 1910, 6,420.]

1907							1				1		2
1908					1				1	1	2	1	6
1909	3	6	1		2								12
1910								2		1			3
1911								2	1	1			4
1912					1		1	3	1				6
1913							2		2				4
1914							2	1	1				4

EAST ORANGE.

[Population, 1910, 34,640.]

1907[1]							2		12		2	2	18
1908	1		1		1	1	3	1	2	10	1		21
1909		1	1	1			1	4	3			1	12
1910	2		1		1		4		6	2	2	7	25
1911	1				2	1	2	3		3	3	1	16
1912	1		2		1		1	6	3	2	2	2	20
1913													None.
1914	1		1		1	4		1	6	6		2	22

TOWNSHIP OF MILBURN.

[Population, 1910, 3,720.]

1906							1	1			1		3
1907								3					3
1908									1				1
1909				1					1				2
1910							1	1				1	3
1911				1									1
1912													None.
1913								1					1
1914						1							1

NEWARK.

[Population, 1910, 349,608.]

1907[1]							22	39	40	42	43	24	210
1908	17	17	5	10	15	14	14	25	19	17	18	8	179
1909	6	10	14	10	14	10	14	30	34	42	16	9	209
1910	9	6	5	7	9	8	21	37	20	32	16	9	179
1911	8	9	6	14	12	25	24	29	37	23	4	14	205
1912	4	10	13	4	20	9	25	37	20	20	16	31	209
1913	12	2	7	10	19	12	21	32	31	20	21	0	187
1914	3	2	4	15	12	18	101	28	21	25	4	11	244

[1] Cases from July on.

Record of typhoid fever cases on watershed of area investigated—Continued.

LUPATCONG CREEK AREA.

KEYPORT.[1]

[Population, 1910, 3,554.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1911–12													None.
1913				1	7	7	1				3		19
1914					2								2

SHREWSBURY AND NAVESINK RIVER AREAS.

BOROUGH OF ATLANTIC HIGHLANDS.

[Population, 1910, 1,645.]

1905–9													None.
1910										1		1	2
1911													None.
1912											1		1
1913–4													None.

TOWNSHIP OF RARITAN.

[Population, 1910, 1,583.]

1910					1	1							2
1911												1	1
1912											1		1
1913											1	2	3
1914													None.

TOWNSHIP OF MIDDLETOWN.

[Population, 1910, 6,653.]

1908													None.
1909											1		1
1910													None.
1911	2					1					2		5
1912				1			1			1		1	4
1913													None.
1914									2				2

BOROUGH OF RED BANK.

[Population, 1910, 7,439.]

1905													None.
1906		1											1
1907–8													None.
1909										1			1
1910									2				2
1911							1		2		1		4
1912	3	2						1	1				7
1913	1	1					1	5					8
1914	1	2	1			1		1					6

BOROUGH OF RUMSEN.

[Population, 1910, 1,449.]

1908												1	1
1909–11													None.
1912								3	7	1			11
1913											1		1
1914					1								1

[1] The record showed no cases of typhoid fever in the Borough of Matawan from 1910 to 1914.

Record of typhoid fever cases on watershed of area investigated—Continued.

SHREWSBURY AND NAVESINK RIVER AREAS—Continued.

LONG BRANCH.

[Population, 1910, 13,391.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1907[1]								3	2	4	4	1	14
1908[2]	4	1											35
1909													(3)
1910									4	2			6
1911						1	2	1	3	56	7	18	88
1912	1	5	5	1	3	2	5	11	6	2		3	45
1913		2	3	1	1	1		1	1	9	4	1	24
1914						1		6	5	1	2	1	16

BOROUGH OF HIGHLANDS.

[Population, 1910, 1,286.]

1905–12													None.
1913									1				1
1914								1					1

TOWNSHIP OF SHREWSBURY.[4]

[Population, 1910, 3,238.]

1910									2				2
1911									1		1		2
1912				2									2
1913			1						2			1	4
1914													None.

ATLANTIC COAST OF NEW JERSEY AREA.

Place.	1900	1901	1902	1903	1904	1905	1906	1907	1908	1909	1910	1911	1912	1913	1914
Allenhurst	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Deal Beach	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Manasquan						2									1
Borough Spring Lake		0	0	0	0	0	0			1	0			4	3
Bradley Beach	0	0	0	1	0	0	0	0	0	0	0			2	1
Pleasantville	9	0	0	2	0	1	0	0	0	0	4			7	26
Ocean City	0	0	1	0	0	0	0	0	0	0	[5]3	2	0	8	7
Cape May City	0	0	1	1	0	2	4	5	0	2	4			2	3
Neptune City	0	0	0	0	0	0	0		0	0	2			0	0
Borough of Avon	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Egg Harbor City	0	0	1	0	0	2	0	1	0	1	0			0	4
Borough Seaside Park	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Beach Haven	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Borough Sea Isle City	0	0	0	0	0	0	0	0	0	0	0	0	0	6	2
Wildwood City	0	0	0	1	0	0	0	0	0	0	2			3	4

[1] Cases from July on.
[2] July to December 30 cases.
[3] No record.
[4] In the township of Eatontown the records showed one case of typhoid fever in June and one in December in 1912, four cases in May, 1913, and one case in August and one in September in 1914.
The local record for the Borough of Seabright showed one case in February, one in August, and two in December in 1913, and one in October and one in December in 1914.
Local records in the Borough of Fairhaven showed one case in September, 1912, and two in the same month in 1914.
[5] 45 cases among nonresidents, probably due to eating raw clams.

Record of typhoid fever cases on watershed of area investigated—Continued.

ATLANTIC COAST OF NEW JERSEY AREA—Continued.

BELMAR. [Estimated population, 1914, 2,553.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
1905	1	3	1		1					1			7
1906		1				2	1						4
1907							1			1			2
1908								2	3	1			6
1909								1					1
1910						1							1
1911					1			2		1			4
1912	2												2
1913									1				1
1914							1			1			2

ASBURY PARK.[1] [Estimated population, 1914, 100,000.]

1907							2	1			3	3	9
1908	2							1	1	3	7	3	17
1909	1		2				1	2	9	10	4		29
1910	1			1			3		2	2			9
1911		1	1			1		7	2			2	14
1912			1			1	2	2	3	7			16
1913			1			1	2	2	1	1		1	9
1914					1	1	2	2	1		1	1	9

ATLANTIC CITY.[1] [Population, 1910, 46,150.]

1900	3	0	4	1	0	1	0	4		4	1	0	18
1901	1	3	2	1	0	2	3	12	13	19	3	1	60
1902	1	0	1	2	2	2	4	10	36	15	9	2	84
1903	3	0	0	1	6	3	3	9	7	3	4	1	40
1904	3	5	2	4	3	0	9	14	6	6	0	5	57
1905	2	2	2	1	1	2	2	11	10	3	6	1	43
1906	1	2	1	2	6	3	7	10	8	14	2	3	59
1907	4	1	2	1	4	3	4	10	9	4	3	1	46
1908	1	2			6								9
1909						1	4	6	5	4	4		24
1910	1			2		1	6	12	10	12	6		50
1911	1	2	1	2			2	4	12	2	1		27
1912	1	0	1	5	4	3	6	7	1	4	1	2	35
1913	5	3				1	4	15	5	5	2	2	42
1914	1	1	1	1		2	1	9	6	11	7	1	41
1915	1	1	2				4	8	4				20

[1] Summer population.

[1] The typhoid fever records at Trenton show that 2 cases occurred at Bay Head in 1914, 1 case in 1904, and 2 cases in 1913.

No record of any cases of typhoid fever at Toms River could be found in the local records or at Trenton.

The typhoid fever records at Trenton show that there was 1 death from this disease in Barnegat in 1913, 1 case in 1910, and 3 cases in 1909. There appear to have been no cases of typhoid fever in Tuckerton from 1900 to 1914.

Island Heights Borough: 1910, no data. 1911, no cases or deaths. 1912, 1 case, July; 2 cases, August; no deaths. 1913, no cases or deaths. 1914, 1 case, October; no deaths.

Ocean Grove (not incorporated): 1910, 1 case, May; 1 case, July; 1 case, September; no deaths. 1911, 1 case, May; 1 case, September; no deaths. 1912, no cases or deaths. 1913, no cases or deaths. 1914, 1 case, July; 1 case, September; 1 death, September.

Point Pleasant Beach Borough: 1910, 1 case, September; no deaths. 1911, no cases or deaths. 1912, 1 case, July; 1 case, September; no deaths. 1913, 1 case, January; 1 case, May; 3 cases, July; 1 death, May. 1914, no cases or deaths.

Sea Girt, not incorporated and no records found.

Record of typhoid fever cases on watershed of area investigated—Continued.

MAURICE RIVER AREA.

MILLVILLE.

Year.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May.	June.	Total.
1907–8	.....	3	3	3	3	.....	.....	1	.....	.....	1	.....	14
1908–9	1	3	2	.....	.....	.....	1	.....	.....	2	.....	.....	9
1909–10	.....	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	1
1910–11	4	1	3	2	1	1	.....	.....	1	1	.....	.....	14
1911–12	1	1	3	3	.....	1	.....	.....	3	.....	.....	.....	12
1912–13	1	3	4	.....	3	.....	.....	.....	.....	.....	3	.....	14
1913–14	.....	6	4	2	1	2	1	.....	.....	.....	3	1	20
1914–15	.....	1	1	1	1	3	.....	1	1	4	.....	1	14

COHANSEY RIVER AREA.

BRIDGETON.[1] [Population, 1910, 14,209.]

1907–8	3	.....	.....	.....	14	1	.....	1	.....	.....	1	.....	20
1908–9	.....	.....	7	1	3	.....	.....	.....	.....	.....	2	.....	13
1909–10	1	.....	1	.....	2	.....	.....	.....	.....	.....	.....	.....	4
1910–11	2	2	3	5	2	6	6	.....	1	1	.....	.....	28
1911–12	6	4	3	2	.....	2	1	.....	.....	.....	.....	.....	18
1912–13	3	4	.....	1	3	1	.....	.....	.....	.....	1	1	14
1913–14	1	.....	.....	2	1	1	1	.....	.....	.....	28	1	35
1914–15	5	9	6	1	.....	1	3	.....	.....	.....	1	1	27

[1] No cases of typhoid fever have been reported in Greenwich Township for the past eight years and no cases could be recalled by the local physicians. It should be remembered that in this township at the village of Greenwich Pier are located the floats in which oysters are laid out before they are shipped.

Hopewell Township, which lies between Greenwich Township and the city of Bridgeton, had 11 cases of typhoid fever reported during the period from 1907 to 1915, of which 6 occurred in the month of September, the others having been chiefly in the summer and autumn.

Fairfield Township, which is below Bridgeton and on the opposite side of the river from Hopewell and Greenwich Townships, showed a record of 12 cases during the period from 1911 to 1915. Of this number, 11 cases were reported from Fairton, an unsewered village on the river below Bridgeton. The cases were rather evenly distributed throughout the year.

APPENDIX III.

Report on Ocean City Outbreak of Typhoid Fever by New Jersey Department of Health.

The Ocean City epidemic of typhoid fever is of especial interest for several reasons.

It is a marked illustration of the danger of a pollution so aptly described by Houston as being—

"Specific, and recent in character, although comparatively small in amount." It is of interest, too, in showing the value of health authorities freely communicating with the health authorities of other communities with reference to cases evidently infected in the town from which they came.

It is believed that the report on this outbreak by the New Jersey Department of Health is well worth reproducing.

OUTBREAK OF TYPHOID FEVER IN OCEAN CITY.[1]

An investigation was begun on September 12 of an outbreak of typhoid fever in Ocean City. Preceding the time of this inquiry no information had been received from the local board of health of Ocean City showing that typhoid fever had prevailed there during the summer months. With information from the bureau of health of Philadelphia, under date of September 10, stating that more than 20 cases of typhoid fever had been reported to said bureau during the preceding week in which infection was claimed to have taken place in Ocean City, and that eight of the persons thus affected had been guests at the Hotel Bellevue, the local board of health was called upon for information concerning the alleged outbreak.

The records in possession of the local health official then showed that three cases of typhoid fever had been reported during the summer. They had occurred in non-permanent resident persons, occupying separate private dwellings, under dates of July 16, August 1, and September 5. Infection in one of these cases had surely occurred before the patient came to Ocean City and one other was probably of foreign origin.

While the local board had no official knowledge that other cases had occurred, a rumor to this effect was under investigation, and evidence had been gathered showing that a number of guests at the hotels Bellevue and Oceanic were taken ill just preceding their departure from Ocean City or shortly following arrival at their homes.

An inspection was at once made at the Bellevue Hotel, which was then being closed for the season, and a request was made of the proprietor for any information in his possession which might assist in procuring the names and addresses of guests who were known to have been ill prior to leaving the hotel, or soon after their departure. This information was refused upon the ground that the lease had expired and the present management had no interest in the matter.

It was learned, however, through an office employee, that the hotel accommodated about 200 guests and employs approximately 40 persons in its management. Apparently reliable information was obtained showing that none of the employees of the hotel

[1] Thirty-fourth Annual Report Board of Health of New Jersey, 1910.

had been ill with typhoid fever. An inspection of the premises showed that the sanitary appliances in the hotel were in good repair and apparently maintained in cleanly manner. Water had been drawn from the public supply and milk obtained from a local dealer. There were no vaults on the premises, and the surroundings were found to be free from objectionable accumulations or structural conditions particularly favorable to the spread of the disease.

A visit was next made to the Oceanic Hotel, where the names of a number of persons were secured who were known to have been ill just prior to leaving or shortly following departure for their homes. Other information was freely given to aid in a search for the probable source of infection. The Oceanic Hotel accommodates about 400 guests and employs about 40 servants. In so far as known there had been no case of illness among the employees that in any way resembled typhoid fever. Except that flies were rather numerous in the kitchen and other rooms connected with the culinary department (probably due to the manner of handling and storing garbage), the sanitary conditions in and about the hotel were satisfactory.

In order that more data might be had to furnish a basis for an intelligent inquiry, a request was made of the department of health of Philadelphia for further and definite information pertaining to the number of cases reported to said department which have a history of having been infected in Ocean City. Pending receipt of this information, with the knowledge at hand, and with the assistance of the local board of health, a study of local conditions which might be responsible for the spread of infection was continued.

So far as known at that time, none of the cases had occurred among employees of the Bellevue and Oceanic Hotels. Inspection of these two premises had revealed no conditions likely to be responsible for the outbreak. The milk and water supplies were investigated with negative results and the possibility of infection from a carrier case inquired into. Considering that there were about 80 employees in the two hotels above named, none of whom had been ill, a source of infection common to guests only was sought for. Owing to the lack of information concerning the number of individuals who had contracted the disease and their movements at the time infection probably took place, few lines of inquiry entirely disassociated from the hotels in question could be carried out. In investigating the source of food supply, it was shown that oysters and clams were among the articles obtained by both hotels from a common source, through which the infection of typhoid fever might be conveyed. Both houses served raw clams and oysters to guests, but not to employees. It also appeared that this same dealer was the only person in Ocean City who had furnished little-neck clams to hotels during the summer. It was learned that these clams had been procured from various beds in near-by waters, while oysters had been obtained from a single shipper at Maurice River. The oysters were not floated or otherwise treated in a manner likely to expose them to infection after they had been received by the dealer. A portion of the clams that were used had been taken from the flats in the thoroughfare which forms the western boundary lines of the island upon which Ocean City is situated. Numerous persons had taken clams from this thoroughfare and some had disposed of their catch to the dealer in question. While no definite knowledge was yet at hand showing that any considerable number of persons who became ill had partaken of uncooked shellfish, this line of inquiry was included in the investigation, and the facts which were gathered shows a condition to have existed which is favorable to the spread of typhoid-fever infection.

It is claimed that only a small portion of the clams taken from the thoroughfare were of the little-neck variety. These were practically all used to serve on the half shell. There can be no doubt that the clams which grew on beds on the thoroughfare were taken from waters which were not only grossly polluted, but also infected by the discharges from typhoid-fever patients. Clams served by the Ocean City dealer were at times stored on a float moored at the dock at the foot of Twelfth Street. As

early as the middle of July one lot was stored on this float for a period of about 10 days. Other lots were subsequently thus stored on dates which could not be definitely fixed. More than a thousand clams, containing some little necks, were purchased by the dealer from a local fisherman during the first week in August, that were then stored on an adjoining float at the foot of Twelfth Street.

About 75 dwellings built on land bordering on the thoroughfare have house drains which discharge directly into the water. In one of these houses, 1342 Pleasure Avenue, a guest who came to the house on July 28 was taken ill with typhoid fever on August 1. The case was treated in the dwelling and the discharges were disposed of through the house drain, which discharges into the thoroughfare at a point not more than 100 yards distant from the clam floats above referred to. A drain from another dwelling discharges into the thoroughfare not more than 20 feet away from these floats.

Outlets of the public sewer discharged crude sewage into the thoroughfare at the foot of Third, Twelfth, and Fifteenth Streets. The summer population of Ocean City is approximately 30,000. The entire sewage from Ocean City is discharged into the thoroughfare, through the above-described outlets, and mingles with the waters which flow back and forth through the thoroughfare and over a number of the beds from which clams are taken, a few hundred feet distant from the sewer outlet.

The last of the data which had been requested from the department of health of Philadelphia, concerning cases that were accredited to Ocean City, was received on December 10. This list included the names of 31 persons, and makes a total of 45 cases which are known to have occurred among persons who had spent some time in Ocean City during the summer. Owing to the fact that the outbreak began about the middle of July, and that no effort was made to determine its source until the second week in September, by which time many of the hotels and cottages had been closed, and most of the infected persons had departed for their homes in other States, it became exceedingly difficult, if not practically impossible, to obtain full and accurate information for a satisfactory study of the cause of the epidemic. Unverified reports of cases have not been included, and there are doubtless other cases that have been entirely overlooked because of the obvious difficulties which were encountered when gathering the facts. A tabulation has been made of the data in hand, from which the following summary is given:

According to information furnished, the infection which caused cases 2, 3, 4, 5, and 25 must have been contracted before the individuals in which it occurred came to Ocean City, and 43 and 44 did not become ill until after the usually accepted incubation period for typhoid fever infection following their departure.

The seven cases above referred to can not, therefore, be chargeable to Ocean City, and the data relating to them have been excluded. Considering clams as a possible source of infection, these cases can, however, be counted as having a bearing on the outbreak, for in so far as is shown by this inquiry they were among the very first to occur, and include case No. 3, which occurred in the dwelling, No. 1342 Pleasure Avenue, from which a house drain discharged into the thoroughfare near the clam floats at the foot of Twelfth Street. The occurrence of these cases must have contributed typhoid infection to the sewage discharged into the thoroughfare just preceding the infection of cases which took place in Ocean City.

There are six cases in which sufficient information has not yet been furnished to determine definitely whether or not infection took place in Ocean City, but inasmuch as the data furnished favor this view, they have been included among the cases shown to have contracted the disease while there. There are 38 cases in which the infection is presumed to have taken place in Ocean City. The statement furnished showing where these persons resided and whether or not they ate raw clams in Ocean City is given in the following table:

Number of typhoid fever cases in Ocean City who had eaten clams.

	Ate raw clams.	Did not eat clams.	No information.	Total number of cases.
HOTEL.				
Oceanic Hotel	7	0	1	8
Bellevue Hotel	5	3	6	15
Normandie Hotel	4	2	0	6
Kathlue Hotel	0	0	1	1
Total	17	5	8	30
PRIVATE HOUSES IN WHICH CASES OCCURRED.				
843 Second Street		1		1
730 West Street		1		1
Fourth and West		1		1
1133 West		1		1
816 Asbury Avenue		1		1
Thirty-fourth Street			1	1
Alpha Phi Club		1		1
Not given			1	1
Grand total	17	11	10	38

The data show that none of the cases which occurred in persons residing in private dwellings ate uncooked clams, while a large percentage of the cases occurring among the hotel guests are said to have eaten them.

The preceding table also shows that 29 out of 30 cases occurred in persons residing in one of three houses. In looking for an explanation why patrons of other hotels should have escaped infection, we have the statement of the shellfish tradesman, who is said to be the only person from whom little-neck clams can be purchased in Ocean City, that very few hotels or boarding houses were supplied with clams by him to be served on the half shell. The names of the following houses are said to have served little-neck clams during the summer:

Bellevue Hotel, served frequently; Oceanic Hotel, served several times each week; Normandie Hotel, served four times during the season, hotel closed September 7; Hotels Strand, Raleigh, Illinois, and Oxford served little necks on alternating Sundays, and the Traymore and Swarthmore were supplied not more than two or three times during the entire season. One or two private houses were supplied with little-neck clams on a few occasions during the summer.

The dates of attack have not been accurately supplied in a number of cases. According to what appears to be a proper arrangement they occurred:

	Cases.
Third week in July	3
Fourth week in July	0
First week in August	4
Second week in August	10
Third week in August	9
Fourth week in August	14
First week in September	8
Second week in September	1
Third week in September	0
Fourth week in September	3
Total	45

The infection therefore appears to have been most active in the latter part of July and during the first part of August. The first few cases in the outbreak, which had

their infection before coming to Ocean City, occurred between the period of July 16 and August 4.

The home addresses of the 45 persons infected are given as: Philadelphia, Pa., 40 cases; Ocean City, 2 cases; Camden, 1 case; Wilmington, Del., 1; Unionville, Pa., 1 case.

The data concerning the ages of the persons having typhoid fever is so incomplete that it bears no significance, and is therefore not given. No cases are recorded, however, in persons under five years of age. There were 29 females and 16 males included in the outbreak. Eight cases are known to have proven fatal, and others were still very ill at the time information was procured.

Owing to the difficulty encountered in gathering much of the data used in the study of this outbreak too much reliance can not be placed upon its accuracy in some cases, and so many facts are lacking in others that no positive conclusions are justifiable as to the true source of infection which caused the epidemic, but strong presumptive evidence exists showing that many of the cases are traceable to infected clams taken from the thoroughfare.

The sewer company and all private owners of properties in Ocean City polluting the waters of the thoroughfare by discharging sewage into its waters, have been notified to discontinue such pollutions, and there should be no repetition of the conditions which led to the epidemic of the past year.

RELATED PUBLICATIONS.

[Unless marked with asterisk, copies of these Bulletins or Reprints may be obtained from the United States Public Health Service, Washington, D. C., without cost. Publications marked with asterisk may be obtained only from the Superintendent of Documents, Government Printing Office, Washington, D. C., at the cost indicated.]

HYGIENIC LABORATORY BULLETINS.

*35. Report on the Origin and Prevalence of Typhoid Fever in the District of Columbia. By M. J. Rosenau, L. L. Lumsden, and Joseph H. Kastle (including the following articles: Sanitary Inspection of Table Waters Vended in Washington, D. C., by Joseph Goldberger; Typhoid Bacillus Carriers, by Joseph Goldberger; The Longevity of B. Typhosus Outside the Human Body, by A. M. Stimson; The Alleged Rule of Intestinal Worms as Inoculating Agents in Typhoid Fever, by Ch. Wardell Stiles; A Sanitary Survey of the Drainage Basin of the Potomac River, by Joseph Goldberger). February, 1907. 361 pages. 9 maps. 7 charts. 2 diagrams. 6 figures. Paper. $1.

*44. Report No. 2 on the Origin and Prevalence of Typhoid Fever in the District of Columbia. 1907. By M. J. Rosenau, L. L. Lumsden, and Joseph H. Kastle. 63 pages. 7 maps. 4 charts. Paper. 25 cents.

52. Report No. 3 on the Origin and Prevalence of Typhoid Fever in the District of Columbia. By M. J. Rosenau, L. L. Lumsden, and J. H. Kastle. October, 1909. 160 pages. 10 charts. 10 maps. Paper.

*66. II. An Organism (pseudomonas protea) Isolated from Water, Agglutinated by the Serum of Typhoid Fever Patients. By W. H. Frost. 14 tables. 4 Charts. References. Paper. 15 cents.

*72. I. Report on an Outbreak of Typhoid Fever at Omaha, Nebr. (1909–1910). By L. L. Lumsden. 6 tables. 4 maps. 5 charts. Appendix.

II. The Water Supply of Williamson, W. Va., and its Relation to an Epidemic of Typhoid Fever. By W. H. Frost. 13 tables. 1 map. 3 charts. November, 1910. 90 pages. Paper. 15 cents.

*77. Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever. I. Lake Erie and the Niagara River. By Allan J. McLaughlin. July, 1911. 169 pages. 55 charts. 16 maps. Paper. 25 cents.

78. Report No. 4 on the Origin and Prevalence of Typhoid Fever in the District of Columbia (1909). By L. L. Lumsden and John F. Anderson. (Including articles contributed by Thomas B. McClintic and Wade H. Frost.) October. 1911. 196 pages. 27 charts. 15 maps. Paper.

*83. Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever. II. Lake Superior and St. Marys River. III. Lake Michigan and the Straits of Mackinac. IV. Lake Huron, St. Clair River, Lake St. Clair, and the Detroit River. V. Lake Ontario and the St. Lawrence River. By Allan J. McLaughlin. March, 1912. 296 pages. 91 charts. 39 maps. Paper. 30 cents.

89. Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever. VI. The Missouri River from Sioux City to its Mouth. By Allan J. McLaughlin. May, 1913. Paper. 84 pages.

96. I. Report of Investigation of Coastal Waters in the Vicinity of Gulfport and Biloxi, Miss., with Special Reference to the Pollution of Shellfish. By R. H. Creel.

II. A Comparison of Methods for the Determination of Oxygen in Waters in Presence of Nitrite. By Elias Elvove. August, 1914.

104. Investigation of the Pollution and Sanitary Conditions of the Potomac Watershed: with special reference to self-purification and the sanitary condition of shell-fish in the lower Potomac River. By Hugh S. Cumming. Plankton Studies by W. C. Purdy, and Hydrographic Studies by Homer P. Ritter. February, 1916.

PUBLIC HEALTH BULLETINS.

*51. The Causation and Prevention of Typhoid Fever, with Special Reference to Conditions Observed in Yakima County, Wash. Appendix A: The Construction and Maintenance of a Sanitary Privy. Appendix B: Measures to Prevent the Spread of Infection from the Bedside of a Typhoid Fever Patient. By L. L. Lumsden. November, 1911. 53 pages. 5 charts. 13 figures. 2 maps. Paper. 20 cents.

*65. Typhoid Fever in Rockville, Md.: Report of an Outbreak Caused by an Infected Water Supply from a Deep Well. By L. L. Lumsden. 5 cents.

74. Investigation of the Pollution of Tidal Waters of Maryland and Virginia, with special reference to shellfish-bearing areas. By Hugh S. Cumming. March, 1916.

REPRINTS FROM PUBLIC HEALTH REPORTS.

*56. Report on an Outbreak of Typhoid Fever at Des Moines, Iowa. By L. L. Lumsden. January 27, 1911. 26 pages. 2 charts. 1 map. Paper. 5 cents.

*67. Origin and Prevalence of Typhoid Fever in Fort Smith, Ark., and Measures Necessary for its Control. By W. H. Frost. October 27, 1911. 19 pages. Paper. 5 cents.

76. The Necessity for Safe Water Supplies in the Control of Typhoid Fever. By A. J. McLaughlin. March 22, 1912. 13 pages. 5 tables. Paper.

*77. Sewage-Polluted Water Supplies in Relation to Infant Mortality. By Allan J. McLaughlin. April 26, 1912. 36 pages. 24 charts. Paper. 5 cents.

104. Outbreak of Gastro-Enteritis and Typhoid Fever Due to Drinking Water on Excursion Steamer. A report of an investigation of an outbreak of gastro-enteritis and typhoid fever at Clinton, Iowa, and other towns along the Mississippi River among excursionists who had been on a river steamer July 29 and 30. By L. L. Lumsden. November 29, 1912.

157. Typhoid Fever and Gastroenteritis. A Report of an Outbreak among Passengers of the Steamship "Rochester" September-October, 1913. By Hugh de Valin. December 19, 1913.

161. The Wilmington (N. C.) Water Supply. An investigation made during November and December, 1913. By Earle B. Phelps. January 9, 1914.

168. The Water Supplies of Ships. A Discussion of the Water Furnished for Drinking Purposes and of the Methods of Sewage Disposal on Ships on Inland Waters. By Hugh de Valin. February 13, 1914.

*181. The Pollution of Tidal Waters. Its Bearing on Health and the Importance to the State of its Control. By Hugh S. Cumming. April 10, 1914. 5 cents.

*204. What is a Safe Drinking Water? By Allan J. McLaughlin. June 26, 1914. 5 cents.

*213. Safe ice. By Hugh S. Cumming. August 7, 1914. 5 cents.

214. Studies on the Self-Purification of Streams. By Earle B. Phelps. August 14, 1914.

225. The Chemical Disinfection of Water. By Earle B. Phelps. October 9, 1914.

*232. Bacteriological Standard for Drinking Water. The Standard Adopted by the Treasury Department for drinking water supplied to the public by common carriers in interstate commerce. November 6, 1914. 5 cents.

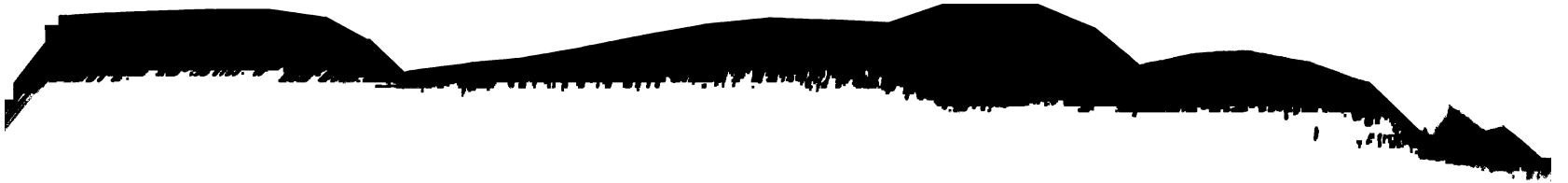
247. Sewage Disinfection for Vessels and Railway Coaches. By Leslie C. Frank. January 1, 1915.

*261. Hypochlorite Treatment of Water Supplies. Portable Plant and Field Equipment for its Administration. By H. A. Whittaker. February 26, 1915. 5 cents.

299. Essentials of Swimming-Pool Sanitation. By Wallace A. Manheimer, Ph. D. September 17, 1915.

351. Artificial Purification of Oysters. A report of experiments upon the purification of polluted oysters by placing them in water to which calcium hypochlorite has been added. By William Firth Wells. July 14, 1916.

362. The Sewage Pollution of Streams. Its relation to the public health. By W. H. Frost. September 15, 1916.



TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 87
NOVEMBER, 1917

DR. STANLEY H. OSHO

STREAM POLLUTION

A DIGEST OF JUDICIAL DECISIONS AND A COMPILAT OF LEGISLATION RELATING TO THE SUBJECT

FEB 2 - Filed NO

By

STANLEY D. MONTGOMERY
and
PROF. EARLE B. PHELPS
U. S. Public Health Service

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 87
NOVEMBER, 1917

STREAM POLLUTION

A DIGEST OF JUDICIAL DECISIONS AND A COMPILATION OF LEGISLATION RELATING TO THE SUBJECT

C. E. STANLEY LIBRARY OF CORN

By
STANLEY D. MONTGOMERY
and
PROF. EARLE B. PHELPS
U. S. Public Health Service

WASHINGTON
GOVERNMENT PRINTING OFFICE
1918

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
30 CENTS PER COPY

ABSTRACT OF CONTENTS.

DEPARTMENT OF OSBORN

	Page.
INTRODUCTION	7
I. DIGEST OF JUDICIAL DECISIONS RELATING TO BASIC RULE OF COMMON LAW.	9
The basic rule of the common law has been stated to be that each riparian proprietor has the right to have the stream come down to him with its quality unimpaired and with its quantity undiminished	9
From the fact that each riparian proprietor has a dual interest in the stream, it logically and necessarily results that each riparian proprietor is permitted to make of the stream a reasonable use and no more	9
And the true rule may be stated to be that each riparian proprietor has the right to have the stream flow through or past his land with its quality unimpaired and its quantity undiminished except in such manner and to such extent as may result from a reasonable use of the stream by riparian proprietors above him	10
Courts have generally favored those uses of a stream that may be classed as natural, such as domestic use, watering of cattle, etc., as distinguished from artificial uses like manufacturing	12
But although a use may be classed as a natural one, if it be exercised immoderately or excessively, it becomes unreasonable and illegal	14
Ordinarily the drainage of surface water can not be made the ground of complaint even though it causes injury to a lower riparian proprietor	14
The owner of lands drained by a watercourse, may change and control the natural flow of the surface water thereon, and by ditches or otherwise accelerate the flow, or increase the volume of water which reaches the stream, and if he does this in the reasonable use of his own premises, he exercises only a legal right, and incurs no liability to a lower proprietor	15
But one draining the surface water into a natural stream will not be permitted to cause the capacity of the stream to be exceeded so as to overflow to the injury of a lower riparian proprietor	15
While the riparian proprietor may accelerate the run-off of surface water into a natural stream he will not be permitted to divert it from its natural course	16
Discharging waste from a manufacturing plant or mine into a stream is not a natural use of the stream and if done to the material injury of the lower riparian proprietor, creates a liability for damages	17
And the fact that a manufacturer is engaged in an important industry, the operation of which benefits the public, will not be held to excuse him for polluting the stream to the injury of the lower proprietor	23
It has been held that even where a lower proprietor can, at comparatively small expense, protect himself against the injury caused by an upper proprietor engaged in an important business, he is not bound to do so	25
The doctrine as to mining uses announced in the Sanderson case, followed only in Pennsylvania and Indiana, and expressly repudiated elsewhere	31
It has been held that evidence of the custom of the region in which the stream is located may be relevant as bearing upon the reasonableness of a given use	43

I. DIGEST OF JUDICIAL DECISIONS, ETC.—Continued. Page.

But other courts have held that evidence of custom can not be relevant.. 44
It has been intimated that new and unusual uses will be regarded more jealously than common and customary ones..... 46
The fact that others than the defendant or even the plaintiff himself are polluting the same stream will not excuse the defendant..... 46
But evidence that others than the defendant have contributed to the pollution of a stream is admissible for the purpose of showing that not all the damage sustained by the plaintiff was caused by the defendant..... 49
Where a stream has been polluted from various causes for longer than a prescriptive period to such an extent that it has become a common sewer, the right to pollute it can not be challenged..... 50
When a stream is polluted by an upper riparian owner in an unreasonable way or to an unreasonable extent, any lower riparian proprietor who is injured thereby has a right of action at common law for the actual damages sustained by him..... 51
It is improper in an action for damages for several riparian proprietors to join as plaintiffs. Each should sue separately for the damages he has sustained 52
It has been held to be improper to join several defendants in an action for damages arising from the pollution of a stream to which the various defendants have contributed independently..... 53
There are some decisions to the contrary, the reasoning being that it is impossible to separate the injury done by the several contributors and that to deny their joint liability is to leave the lower proprietor without remedy for the injury he has sustained..... 54
So where the cause of injury to a stream has been maintained by succeeding proprietors, the lower proprietor will not be permitted to join them in an action for damages but must sue each separately..... 57
An unreasonable use of a stream which pollutes it to the injury of a lower riparian proprietor will be enjoined..... 57
Several who contribute individually to the pollution of the same stream may be joined as defendants in one suit for an injunction..... 59
Several individuals who are injured by the pollution of the same stream may join in an action for an injunction..... 60
To entitle a riparian owner to an injunction against polluting a stream, the injury of which he complains must be real and material..... 61
But although the injury to the stream must be real in order to entitle the plaintive to injunctive relief, it does not follow that the plaintiff must have suffered any actual damage in his present use of the stream..... 61
In suits for injunction against pollution of streams the general rule that a nuisance will not be enjoined in an equity suit until its existence has first been established in an action at law does not obtain, the reason being that the delay incident to the establishing of the right in an action at law might cause irreparable injury..... 65
Where the effect produced by the pollution of a stream amounts to a public nuisance, the State by its attorney general may bring an action for an injunction against the continuance of the pollution..... 67
As against a lower riparian proprietor a right to pollute a stream may be acquired by prescription..... 68
But where a right by prescription is acquired, it is limited to the use actually made during the entire statutory period..... 68
A right to create a public nuisance can not be acquired even by prescription 70
Nor can a right by prescription be acquired which will authorize the doing of anything forbidden by statute..... 72

I. DIGEST OF JUDICIAL DECISIONS, ETC.—Continued. Page.
By the great weight of authority, municipalities have no greater rights than individuals to pollute water courses and must respond in damages for an injury caused to a lower riparian proprietor and may be enjoined from continuing the pollution ... 72
A municipality is not liable for the pollution of a stream caused by the ordinary drainage of surface water ... 78
But where a city alters the natural course of drainage and causes material increase in the quantity of the flow in a given direction and material injury results, the city is liable for the injury ... 81
Nor will a city be permitted to build artificial drains and thereby conduct surface water into a stream in such quantities as to exceed the capacity of the stream and cause the same to overflow to the injury of a lower proprietor ... 84
At common law a city seeking to maintain the purity of a stream, as a lower riparian proprietor, has no greater right than an individual to limit the use of the stream by upper proprietors ... 85
II. DIGEST OF JUDICIAL DECISIONS RELATING TO STATUTES ... 88
Introduction ... 88
To protect its streams against pollution, a State may, without providing compensation, curtail the rights of the riparian owner in his use of the stream, according to the weight of authority ... 89
Even though a riparian owner may have acquired a right by prescription as against lower proprietors on the stream to pollute the same, he is nevertheless amenable to legislation enacted under the police power for the preservation of the purity of the stream and can not claim compensation unless the same is provided in the legislation ... 99
Such legislation is not rendered invalid by the fact that it is made applicable to a portion of the State only, provided no unreasonable or arbitrary classification be adopted ... 101
Most courts construe strictly statutes for this purpose and hold that such construction does not render them unconstitutional ... 105
Some courts have held that statutes enacted for the preservation of streams should be liberally construed in favor of the riparian owner ... 109
A State may leave to a commission or board the details of legislation for protection of its waters ... 114
The power of the State to authorize the discharge of sewage into streams to the injury of lower proprietors is limited by constitutional provisions. 117
By the great weight of authority statutes will not be construed as authorizing municipalities to create nuisances by the discharge of sewage, even in those jurisdictions where the constitutional inhibition does not obtain... 124
Table of cases ... 133
APPENDIX I. Treaty with England as to boundary waters between United States and Canada ... 147
APPENDIX II. COMPILATION OF STATE LAWS AND REGULATIONS ... 148

STREAM POLLUTION.

A DIGEST OF JUDICIAL DECISIONS AND A COMPILATION OF LEGISLATION RELATING TO THE SUBJECT.

INTRODUCTION.

In connection with the studies of the pollution of streams and other water supplies being conducted by the United States Public Health Service, it was found necessary to ascertain the precise status of legislation relating thereto, inasmuch as the whole subject of the control of stream pollution is bound up with the limitations imposed by common law and statute. Although a knowledge of the laws themselves was required, more important was a knowledge of court decisions and an analysis of the trend of these decisions. The courts have devoted continuous attention to this problem. In fact, until recent years, when the States began enacting specific legislation on the subject, the rights of riparian owners and others suffering from pollution of their water supplies were enforced by court decisions interpreting the provisions of the common law. Even now it is to these decisions more than to the law itself that one must turn for an understanding of how the problem is being met from a legal point of view. For these reasons a digest of court decisions was prepared and is given herewith, supplemented by a compilation[1] of all of the State laws and health regulations which seem closely related to the subject of the pollution of streams. The digest itself begins with a discussion of the basic rule of common law—that each riparian proprietor has the right to have the stream come down to him with its quality unimpaired and with its quantity undiminished—and indicates the manner in which this rule has been qualified by other common-law principles and by changing conditions. This section is followed by a discussion of the interpretation given the important statutes on the subject in court decisions.

The digest bears very closely upon the subject of the control of stream pollution, and the limitations of such control under the law and under the precedents of the courts are indicated. The obliga-

[1] In general the compilation includes laws in force at the end of the 1917 sessions of the various State legislatures. See p. 149, for list of States of which this is not true.

tion imposed by the Government upon itself in the treaty with England regarding the boundary waters between the United States and Canada (January 11, 1909) is emphasized.

It is hoped that the volume will throw some light upon the difficult questions which the increasing use of streams for both water supplies and sewage disposal brings up. This double use of the streams of the country has made the whole subject of the pollution of streams of great importance, and any clarification of the problem which a study of the common law and statutes can give in this matter would appear worth while. It may also be expected that such a study will aid in bringing about more uniformity in the legislation on stream pollution in the different States.

I. DIGEST OF JUDICIAL DECISIONS RELATING TO BASIC RULE OF COMMON LAW.

THE BASIC RULE OF THE COMMON LAW HAS BEEN STATED TO BE THAT EACH RIPARIAN PROPRIETOR HAS THE RIGHT TO HAVE THE STREAM COME DOWN TO HIM WITH ITS QUALITY UNIMPAIRED AND WITH ITS QUANTITY UNDIMINISHED.

Thus it has been said:

Every owner of land through which a stream of water flows is entitled to the use and enjoyment of the water, and to have the same flow in its natural and accustomed course, without obstruction, diversion, or corruption. The right extends to the quality as well as to the quantity * * *. (Holsman *v.* Boiling Spring Bleaching Co. (14 N. J. Eq. 335), decided 1862.)

But expressions like the above are extreme statements of the rule and can not be accepted literally.

FROM THE FACT THAT EACH RIPARIAN PROPRIETOR HAS A DUAL INTEREST IN THE STREAM, IT LOGICALLY AND NECESSARILY RESULTS THAT EACH RIPARIAN PROPRIETOR IS PERMITTED TO MAKE OF THE STREAM A REASONABLE USE AND NO MORE.

That is to say, each riparian proprietor is interested, on the one hand, in having the water come down to him in its natural state and in its full volume. On the other hand, he is interested in making the largest use of the stream which his convenience or interest may dictate; and since almost any use of the stream has some tendency either to diminish the volume or to lessen its purity, or both, it follows that a rule which would preclude each riparian owner from polluting the stream at all or from diminishing its volume at all would defeat its own purpose; and this has been recognized by the courts. Thus, in the case of Tetherington *v.* Donk Bros. Coal & Coke Co. (232 Ill. 522), decided February 20, 1908, the supreme court said:

The law has been announced in this court in numerous decisions that it is the right of every owner of land over which a stream of water flows to have it flow in its natural state and with its quality unaffected; that the "right to a stream of water is as sacred as a right to the soil over which it flows. It is a part of the freehold of which the owner can not be disseized except by due process of law, and the pollution of a stream constitutes the taking of property, which may not be done without compensation." City of Kewanee *v.* Otley (204 Ill. 402); Beidler *v.* Sanitary District (211 id. 628).

Appellant's argument is, that the enforcement of the right of the lower riparian owner literally as laid down in the instruction and the authorities would exclude the riparian owners above from the enjoyment of any use of the stream, except such as would not diminish the quantity or impair the quality of

the waters. Language such as we have quoted from the decision above referred to is to be understood as a strong expression of the general principle employed in cases in which it did not become necessary to consider how far there might be exceptions, or how far one might be heard to complain of insignificant injuries, which left the stream to flow on without substantial change. The rights of the several riparian owners on the watercourse are relatively equal. While the right to acquire and enjoy property is an absolute right which existed back of all constitutions and laws, still the means of acquisition and the manner of enjoyment are subject to regulation by law and are relative. In a strict and highly technical sense any use of a stream of water may diminish the quantity or impair the quality in some infinitesimal degree, but it is not this sense in which the law assures the right of a riparian owner to the use of the stream. It would be of no avail to a landowner to give him such a right, for in turn the next lower riparian owner would have the same strict right to have the stream come to him in like condition, so that no one would have a right to do more than stand on the shore and see the stream flow by him. The right of each proprietor to use the stream is subject to a like reasonable right in other riparian owners, and each must submit to such reasonable use by his neighbor so long as such use does not inflict substantial injury upon other owners who have a like right. When questions arise between riparian owners respecting the right of one to make a particular use of the water in which they have a common right, the right will generally depend on the reasonableness of the use and the extent of the detriment to the lower owner.

AND THE TRUE RULE MAY BE STATED TO BE THAT EACH RIPARIAN PROPRIETOR HAS THE RIGHT TO HAVE THE STREAM FLOW THROUGH OR PAST HIS LAND WITH ITS QUALITY UNIMPAIRED AND ITS QUANTITY UNDIMINISHED EXCEPT IN SUCH MANNER AND TO SUCH EXTENT AS MAY RESULT FROM A REASONABLE USE OF THE STREAM BY RIPARIAN PROPRIETORS ABOVE HIM.

In Mayor of Baltimore *v.* Warren Manufacturing Co. (59 Md. 96), decided 1882, it was said:

What nature and extent of pollution of the stream will call for the active interference of the court is not in all cases easy to define. It is not every impurity imparted to the water, however small in degree, that will be the subject of an injunction. All running streams are, to a certain extent, polluted; and especially are they so when they flow through populous regions of country and the waters are utilized for mechanical and manufacturing purposes. The washings of the manured and cultivated fields and the natural drainage of the country of necessity bring many impurities to the stream, but these and the like sources of pollution can not ordinarily be restrained by the court. (Wood *v.* Sutcliffe (2 Sim. (N. S.) 163).) Therefore when we speak of the right of each riparian proprietor to have the water of a natural stream flow through his land in its natural purity those descriptive terms must be understood in a comparative sense, as no proprietor does receive, nor can he reasonably expect to receive, the water in a state of entire purity. But any use that materially fouls and adulterates the water, or the deposit or discharge therein of any filthy or noxious substance, that so far affects the water as to impair its value for the ordinary purposes of life will be deemed a violation of the rights of the lower riparian proprietor and for which he will be entitled to redress. * * *

And in Honsee *v.* Hammond (39 Barb. (N. Y.) 89), in sustaining the charge of the trial judge, the court said:

* * * He very properly refused to charge that the action could not be maintained for throwing tan bark into the river when it was done without intent to injure and in the usual manner in which the water was used in the tanneries. The judge had previously charged that both parties had a right to the use of the water for all legitimate purposes; but that one riparian proprietor had no right so to use the water as to fill or clog it with foreign and noxious matter which would materially interfere with the use of the water below, and to the damage and injury of the owner, and thereby greatly impair or destroy the use of the property. The principle laid down was clearly correct. * * *

The Supreme Court of Tennessee has held in Cox *v.* Howell (108 Tenn. 133; 58 L. R. A. 487; 65 S. W. 868) as follows:

* * * The general proposition of law that the owner of land across or over which a stream of water flows has a right to have it flow over the land in its natural channel, undiminished in quantity and unimpaired in quality, except so far as is inseparable from a reasonable use of the water from the stream for the ordinary and useful purposes of life by those above him on the stream, is well established by an almost unbroken current of authority.

Cited with approval in H. B. Bowling Coal Co. *v.* Ruffner (117 Tenn. 180), decided February 19, 1907. And the New York Court of Appeals has said, in Strobel *v.* Kerr Salt Co. (164 N. Y. 303), decided 1900:

* * * A riparian owner is entitled to a reasonable use of the water flowing by his premises in a natural stream, as an incident to his ownership of the soil, and to have it transmitted to him without sensible alteration in quality or unreasonable diminution in quantity. While he does not own the running water, he has the right to a reasonable use of it as it passes by his land. As all other owners upon the same stream have the same right, the right of no one is absolute, but is qualified by the right of the others to have the stream substantially preserved in its natural size, flow and purity, and to protection against material diversion or pollution. This is the common right of all, which must not be interfered with by any. The use by each must, therefore, be consistent with the rights of the others, and the maxim of sic utere tuo observed by all. The rule of the ancient common law is still in force; aqua currit et debet currere, ut currere solebat.

And the same court said, in the later case of City of New York *v.* Blum (208 N. Y. 237), decided April 22, 1913:

The general rules governing the rights of riparian owners are well established and the bare statement of them will suffice. Each is entitled to a reasonable use of the water flowing by his premises and each is entitled to have the stream preserved in its natural size, flow, and purity (citing Strobel *v.* Kerr Salt Co., supra).

And in Worthen and Aldrich *v.* White Spring Paper Co. (74 N. J. Eq. 647), decided June 10, 1908, it was said:

The defendant is, of course, entitled to a reasonable use of the water of the stream, but that use must be lawful and must be exercised with due regard to the lawful rights of lower proprietors and especially is this true as to the charge of pollution.

The courts may be said to be substantially unanimous in recognizing the right of each riparian proprietor to make a reasonable use of the stream.

In the application of the principle, the decisions have been somewhat conflicting. There are, however, a number of general principles that appear to have the sanction of substantially all the courts where the common law obtains.

COURTS HAVE GENERALLY FAVORED THOSE USES OF A STREAM THAT MAY BE CLASSED AS NATURAL, SUCH AS DOMESTIC USE, WATERING OF CATTLE, ETC., AS DISTINGUISHED FROM ARTIFICIAL USES LIKE MANUFACTURING.

In the case of People *v.* Hulbert (131 Mich. 156), the respondent was a riparian proprietor on the banks of Goguac Lake in the waters of which he was in the habit of swimming. The city of Battle Creek purchased a piece of land with a 200-foot frontage on the lake and installed a pumping station to supply the city with water. It then caused the arrest of the respondent for swimming in the lake on the theory that it tended to pollute the water supply and was a criminal nuisance. The Michigan Supreme Court said:

> The first question calling for consideration is, Was the act of respondent unlawful? It is a matter of common knowledge that in this State the riparian owners whose lands border upon lakes, and through whose lands streams run, are in the habit of using the streams and lakes by allowing their domestic animals to drink therein, and by drawing therefrom what water may be needed for domestic purposes; and themselves and their families resort to the water of the streams and lakes for the purpose of bathing at suitable seasons of the year. It is also known that, as a rule, the supply of cooking and drinking water is obtained from springs or wells. Will the fact that a lower riparian proprietor decides to use the water of the stream or lake for drinking and cooking purposes make a reasonable use of the water by the upper riparian owners for the purposes of watering cattle and bathing purposes unlawful because to do so has a tendency to make the water less desirable for drinking and cooking purposes? Can the upper proprietors be deprived of such reasonable and ordinary use when the lower proprietor is a city having a large population by invoking the police power, and without compensation? It will readily be seen these are very important questions. The diligence of able counsel has failed to call our attention to a case on all fours with the one at bar, but the principles involved are not new.
>
> * * * * * * *
>
> It is very clear that the lower proprietor has no superior right to the upper one, and may not say to him that, because the lower proprietor wants to use the water for drinking purposes only, the upper proprietor may not use the water for any other purpose. Each proprietor has an equal right to the use of the stream for the ordinary purposes of the house and farm, even though such use may in some degree lessen the volume of the stream or affect the purity of the water.

So in Helfrich *v.* Catonsville Water Co. (74 Md. 269; 13 L. R. A. 109), where a water company, chartered for the purpose of supplying pure water to the inhabitants of Catonsville and the adjacent

portion of Baltimore County, acquired a tract of land, constructed works, etc., upon a clear natural stream of water which flowed through the land of the appellant Helfrich about 140 rods above the land of the water company. Helfrich owned six cows, which he pastured in a lot which adjoined the stream. The water company filed a bill praying for an injunction restraining Helfrich from permitting his cows to enter or stand in the stream, alleging that the water was greatly polluted and befouled by the cattle, etc. The trial court granted an injunction, but upon appeal the Court of Appeals of Maryland reversed the trial court, on the ground that the use which Helfrich was making of his property in pasturing his cattle on the stream was a reasonable use in view of the character of the land and its adaptability to pasturing purposes, etc., and that the water company had no right to complain of incidental injury resulting therefrom. Said the court:

So far as we can see from the record, there was nothing unreasonable or unusual in the way in which the cattle were pastured in this lot. * * * He seems to have used his pasture as all men, time out of mind, have done in like cases. We are not unmindful of the vast number of cases where persons have been enjoined from committing nuisances in running streams and from depositing or permitting to be deposited in them noxious, deleterious, or unwholesome matter, and from any unlawful or unreasonable thing which impairs the legitimate use of the water by riparian owners. Nor have we overlooked the numerous cases where it has been held that certain kinds of manufacturing establishments have infringed the vested rights of such owners. Our opinion is placed on the distinct ground that Helfrich was using his pasture lot in a reasonable manner, and that he had a right so to use it. His right was not in any way abridged by the incorporation of the water company and the establishment of its works.

So in the case of McEvoy *v.* Taylor (56 Wash. 357; 105 Pac. 851), decided December 16, 1909, where the defendant was the owner of a small tract of land on the outskirts of Walla Walla on which was a small pond 20 by 40 feet from which a small stream flowed across the plaintiff's property. Plaintiff sued for an injunction prohibiting the defendant from allowing his horses, cattle, geese, etc., from entering into and polluting the waters. This injunction was granted by the lower court. Defendant appealed. Although it appeared that the water was somewhat polluted as the result of the use made of the water by the defendant, the supreme court said:

It can not be gathered from all the evidence of respondents but that the use of the spring and pond by appellants was a natural use. They had the right to use the spring and pond to water their cattle or for their geese to swim upon, and the pollution of the water, being a natural incident to a proper and reasonable use, can not be restrained nor prevented.

* * * * * * *

We therefore hold that appellant's use of the spring and pond was a natural and reasonable use, and that it can not be enjoined.

And reversed the decision of the court below.

And in Beach *v.* Sterling Iron & Zinc Co. (9 Dick. (N. J.) 65. affirmed in 10 Dick. 824), the court held:

By the common law of the land every owner may cultivate his land without regard to its effects to his neighbor, while such is not the law as to mining.

BUT ALTHOUGH A USE MAY BE CLASSED AS A NATURAL ONE, IF IT BE EXERCISED IMMODERATELY OR EXCESSIVELY, IT BECOMES UNREASONABLE AND ILLEGAL.

Thus in Helfrich *v.* Catonsville Water Co. (supra), while recognizing the defendant's right to make a reasonable use of the stream, the court said:

* * * If Helfrich had wantonly or recklessly befouled the water of the stream, or had harassed the water company or injured its business by an immoderate and excessive exercise of his acknowledged rights, he would justly have been responsible for his conduct.

And in People *v.* Hulbert (supra), while upholding the right of the defendant as a riparian proprietor to bathe in the waters of the lake, the court said:

In what we have said we do not mean to intimate that an upper proprietor may convert his property into a summer resort, and invite large numbers of people to his premises for the purposes of bathing, and give them the right possessed only by the riparian owner and his family. We are undertaking to decide only the case which is presented here.

And in City of New York *v.* Blum (supra), the New York Court of Appeals upheld the plaintiff's right to an injunction upon the distinct ground that the manner and extent of defendant's use of his pond in allowing large number of water fowls to swim thereon, etc., was unreasonable at common law. And in Barton *v.* Union Cattle Co. (28 Nebr. 35; 44 N. W. 454; 7 L. R. A. 457) the defendant company was an upper proprietor on the Papillion Creek and maintained on its premises some 3,500 cattle. The drainage from the premises greatly polluted the water of the stream to the injury of the plaintiff. The supreme court, in granting an injunction, held that while the business of the defendant "might be legitimately carried on without damage to a lower owner upon a stream like the Missouri or Platte," yet it could not "be carried on without infringing upon the rights of the lower landowner upon a stream of the size of the Papillion."

ORDINARILY THE DRAINAGE OF SURFACE WATER CAN NOT BE MADE THE GROUND OF COMPLAINT EVEN THOUGH IT CAUSES INJURY TO A LOWER RIPARIAN PROPRIETOR.

The case of Waffle *v.* N. Y. Central Ry. Co. (53 N. Y. 11) was one which arose from the fact that the defendant had drained a swamp in such a manner that the water ran into the stream more rapidly than it otherwise would have run, and that as a result the flow of the stream in which it ran was less even. This injured the defendant, who owned a mill 2 miles down the stream, because at

times it made the water too high and at other times too low. The court held that the defendant had the right to thus drain his land and there was no liability. And in McCormick *v.* Horan (81 N. Y. 86) it was said:

"THE OWNER OF LANDS DRAINED BY A WATERCOURSE, MAY CHANGE AND CONTROL THE NATURAL FLOW OF THE SURFACE WATER THEREON, AND BY DITCHES OR OTHERWISE ACCELERATE THE FLOW, OR INCREASE THE VOLUME OF WATER WHICH REACHES THE STREAM, AND IF HE DOES THIS IN THE REASONABLE USE OF HIS OWN PREMISES, HE EXERCISES ONLY A LEGAL RIGHT, AND INCURS NO LIABILITY TO A LOWER PROPRIETOR."

And in Jackman *v.* Arlington Mills Co. (137 Mass. 277) it was held that an owner—

has a right to collect the surface water and the natural drainage of his land into an artificial stream and discharge it into a natural watercourse which is the natural outlet of the waters thus collected, even although by this artificial arrangement the flow of the waters is accelerated and the volume at times is increased, provided that this is done in the reasonable use of his own land, and that the discharge is not beyond the natural capacity of the watercourse and the land of a riparian owner is not thereby overflowed and materially injured.

Sowers *v.* Schiff (15 La. Annual 30) was a case in which the plaintiffs were upper proprietors and owners of a plantation who sued the defendants for an injunction against damming back the water from the plaintiff's land and causing it to back up to the injury of the plaintiff. There was no question but what there was a natural servitude, but the defendants attempted to justify their act of damming back the water by claiming that the plaintiffs had accelerated the flow and discharged water in excess of the amount which their servitude authorized. The facts are not very fully stated, but the opinion indicates that there was no very serious injury to the defendants. The court said:

Upon the whole we are of the opinion that the aggravation of the servitude was authorized, as it had for its object the interest of agriculture and did not tend to redeem swamp lands nor turn the natural course of water in another direction.

BUT ONE DRAINING THE SURFACE WATER INTO A NATURAL STREAM WILL NOT BE PERMITTED TO CAUSE THE CAPACITY OF THE STREAM TO BE EXCEEDED SO AS TO OVERFLOW TO THE INJURY OF A LOWER RIPARIAN PROPRIETOR.

Jackman *v.* Arlington Mills Co., 137 Mass. 277.
Kauffman *v.* Griesner, 26 Pa. St. 407.

There is a North Carolina case which it is believed goes much further than any other court has gone in permitting the acceleration of the run-off of surface water by an upper riparian owner.

In the case of Mizell *v.* McGowan (120 N. Car. 134), decided 1897, the defendant was the owner of swamp land which he desired to redeem and the plaintiff was a lower riparian proprietor on a stream

into which the swamp drained. The defendant dug canals in this swamp which had the effect of so accelerating the run-off to the stream, Broad Creek, that the same was caused to flow upon the land of the plaintiff, who brought suit for damages. The following from the opinion of the court is sufficient to indicate the holding:

The defendant asked the court to charge the jury that if they find from the evidence that Broad Creek and Moyes Run are natural water courses and that the waters of the upper swamps naturally flow therein, and were susceptible of drainage for agricultural purposes, then the defendant had a right to make such canals in these swamps as were necessary to drain them of the water naturally falling thereon, although in so doing the flow of water in Moyes Run was thereby increased and accelerated, and the flow of water was increased on the plaintiff's land. This prayer embraces the substance of all the prayers. His honor modified the prayer by saying "provided he does not thereby damage said land." Defendant excepted.

We think (said the supreme court) his honor should have given the defendant's prayer in substance without the proviso. * * *

The upper owner can not divert and throw water on his neighbor, nor the latter back water on the other with impunity. Sic utere tuo ut alienum non laedas. This rule, however, can not be enforced in its strict letter, without impeding rightful progress and without hindering industrial enterprise. Minor individual interest must sometimes yield to the paramount good. Otherwise the benefits of discovery and progress in all the enterprises of life would be withheld from activity in life's affairs. "The rough outline of natural right or liberty must submit to the chisel of the mason that it may enter symmetrically into the social structure." Under this principle the defendants are permitted not to divert, but to drain their lands, having due regard to their neighbor, provided they do not do more than concentrate the water and cause it to flow more rapidly and in greater volume down the natural streams through or by the lands of the plaintiff. This license must be conceded with caution and prudence.

The doctrine that "minor individual interests must yield to the paramount good," and that the rights of riparian proprietors must sometimes surrender to other riparian proprietors having larger and more important interests, will be met with again in connection with the rights of manufacturers, mining concerns, etc., and therefore need not be discussed further here. Suffice it to say that this is the only case that has been found in which the rights of a riparian proprietor engaged in farming have been made to yield to those of another riparian proprietor desiring to redeem swamp lands for the purpose of farming.

WHILE THE RIPARIAN PROPRIETOR MAY ACCELERATE THE RUN-OFF OF SURFACE WATER INTO A NATURAL STREAM HE WILL NOT BE PERMITTED TO DIVERT IT FROM ITS NATURAL COURSE.

Thus in Wolcutt *v.* Wilmington & Weldon Ry. Co. (124 N. C. 214) it was said:

It is now well settled that neither a corporation nor an individual can divert water from its natural course so as to damage others. They may increase and accelerate but not divert. (Jenkins *v.* Ry., 110 U. S. 438; Parker *v.* Ry., 123 U. S. 171.)

And in N. N. & M. V. Co. *v.* Wilson, etc. (16 Ky. Law Repts. 262) it was held that—

* * * While one may lawfully drain his land into a natural watercourse, even though by so doing a lower proprietor is injured by the increased flow, yet that such a right does not authorize one, by dumping débris, rock, and other obstacles in the channel, to change the course of the stream to the injury of a lower owner.

DISCHARGING WASTE FROM A MANUFACTURING PLANT OR MINE INTO A STREAM IS NOT A NATURAL USE OF THE STREAM AND IF DONE TO THE MATERIAL INJURY OF THE LOWER RIPARIAN PROPRIETOR, CREATES A LIABILITY FOR DAMAGES.

In Packwood et ux. *v.* Mendota Coal and Coke Co. et al. (84 Wash. 47, 146 Pac. 163), decided in 1915, an action was brought by plaintiffs, who were owners of a farm through which ran a natural stream of water and who sued and recovered $1,000 against the defendants for polluting the waters of the stream. Defendants were engaged in mining coal. In preparing it for the market the coal was washed by water taken from the creek, and after flowing through the washing machinery the water "flowed back into the stream, carrying with it quantities of fine coal, rendering, as the evidence tends to show, the water flowing in the stream through respondents' farm unfit for domestic and farm purposes, and especially unfit for watering stock, which is its principal value to respondents."

The supreme court said:

If the acts of the company resulted in the pollution of the water of the stream flowing through respondents' farm to a substantial degree, and rendered it materially less suitable for domestic and farm purposes, and they thereby suffered substantial damages, appellants became liable therefor, though this might not be the limit of the company's right to the use of the water as riparian owner, were it putting the water to ordinary domestic and farm uses, under the law as announced by us in McEvoy *v.* Taylor (56 Wash. 357; 26 L. R. A. (N. S.) 222), where we held in effect that the use of the water of a stream by a riparian owner for ordinary farm and domestic purposes, such as allowing his horses, cattle, and fowl free access thereto, was a reasonable use, and did not render him liable in damages to a lower riparian owner entitled to the use of the water for farm and domestic purposes, though such use rendered the water materially less pure to such lower riparian owner's substantial damage.

The use of the water of a stream for industrial or manufacturing purposes by a riparian owner, by which it is polluted with a foreign substance, we think is quite another matter, when it comes to testing such owner's right as against a lower riparian owner entitled to the use of the water for farm and domestic purposes. In such cases at least, and possibly some others, we believe the law to be that the right to the reasonable use of water by a riparian owner for manufacturing or industrial purposes, resulting in the pollution of the water with foreign substances, is limited to the extent that such use must not materially pollute the water to the substantial damage of the lower riparian owner. This, we think, is the fair import of these instructions.

And after quoting at length from Snow *v.* Parsons (28 Vt. 459; 67 Am. Dec. 723), Merrifield *v.* Lombard (13 Allen (Mass.) 16, 90 Am. Dec. 172), Day *v.* Louisville Coal and Coke Co. (60 W. Va. 27, 10 L. R. A. (N. S.) 167), and Tenn. Coal, Iron and R. Co. *v.* Hamilton (100 Ala. 252, 261, 46 Am. St. Rep. 48), the court said:

We believe it safe, however, to say that in the absence of rights resting upon prescription or custom, neither of which is here involved, there can be no more practical or just rule of liability resting upon riparian owners using the water of a stream for industrial or manufacturing purposes, and thereby polluting the water with foreign substances, than that damages caused by such use and pollution of the water renders such user liable to a lower riparian owner entitled to use of the water for domestic and farm purposes, whenever such damage is of a substantial nature. This of necessity results in the question being one for the jury, except in cases where the evidence is such as to leave no room for honest difference of opinion as to the substantial nature of the damage.

It will be noted that the Supreme Court of Washington was at some pains to make clear the fact that the use that it was protecting by the rule which it laid down was a natural one, and whether the same rigid rule could be invoked for the protection of a lower proprietor engaged in an industrial or manufacturing enterprise may be doubtful.

But in Massachusetts substantially the same rule was applied where the question arose between manufacturers. In the case of Parker *v.* American Woolen Mills Co. (195 Mass. 591; 81 N. E. 468; 10 L. R. A. (N. S.) 584), decided May 28, 1907, the defendant company was enjoined against the discharge of waste into Beaver Brook, the plaintiff being an owner of a paper mill below the defendant on that stream. The court, after citing numerous cases in Massachusetts and other States and a number of text writers, said:

* * * The right to use the stream to carry away mere waste matter in a reasonable manner and to a reasonable extent is not so to be extended as to include a right to discharge into the stream noxious and deleterious matter to such an extent as sensibly and materially to foul the water and destroy its purity and fitness to be used by others.

It is true, of course, that there is in any large body of water a purifying principle which will, either by ordinary sedimentary deposit or by chemical change, obviate the evil effects which otherwise would arise from the deposit therein of some limited amount of noxious matter. Accordingly, it is not for every small deposit of such matter that the law will give a remedy. This was the case in Brookline *v.* Mackintosh (133 Mass. 215). There doubtless must be a material and sensible deterioration of the quality of the water. * * *

and entered a decree enjoining the defendant—

from emptying or discharging into the brook upon its premises, above the plaintiff's premises, any acids, soaps, compounds of soap, or of iron, chemicals, scourings, dyestuffs, sewage, or any objectionable substances whatever, in quantities that noticeably or appreciably affect the purity of the waters when they reach the plaintiff's premises, or render them materially less fit for drink-

ing, domestic, or other uses at that point than they are when they enter the defendant's premises. * * *

The court observed that it would be impossible for it to make the terms of the injunction more express. It was said:

Defendant must at its peril see that it does not overpass this limit.

In the later case of MacNamara *v.* Taft (196 Mass. 597; 83 N. E. 310; 13 L. R. A. (N. S.) 1044), decided January 1, 1908, the facts were thus stated by the court.

The defendant owns a mill containing four sets of machinery for the manufacture of satinet cloth. It is upon a small stream which in its natural state is 8 to 12 feet wide and from 3 to 6 feet deep. The mill is run in part by water power and in part by steam power. The plaintiff owns a farm containing about 50 acres of land nearly a mile below, through which the stream flows on its way to French River. This bill is brought to obtain an injunction against the pollution of the water by the discharge of noxious matter into it. The evidence shows that the defendant used daily at this mill a large quantity of oil, put upon the material before it is spun, and 180 pounds of soap, 165 pounds of soda ash, 45 pounds of soda salts, 200 pounds of extract of logwood, and 43 pounds of blue vitriol in fulling and dyeing his cloth. After these chemicals are put into the fulling mill and taken up by the cloth, the cloth is placed in washers and washed. A large part of the logwood and vitriol, and substantially all of the other chemicals, are washed out and discharged into the stream. The effect of this discharge is to make the water dark in color and to give it an oily odor and taste such as to prevent the plaintiff's cows from drinking it, as they are pastured on the banks of the stream below.

The limit upon the right of the upper proprietor to pollute the stream is discussed by the court in the following language:

* * * Ordinarily, the question whether the use of a stream by an upper riparian owner is reasonable is a question of fact. The reason why such a question is open, in many cases, is that certain uses of a stream which are universally recognized as lawful may diminish the quantity of the water or affect its quality to some extent. The watering of cattle may permanently abstract from the stream so much as they drink. The use of land for the pasturage of cattle may roil the water as they pass through it if the banks and bed of the stream are muddy, or cause the dropping of excrement into it, which will slightly affect its quality when it reaches the land of the next owner, just across the boundary line. The cultivation of land may cause earth to be washed into the stream. Such uses, carefully regulated, are not unreasonable, and the right of the owner below is subject to the exercise of these rights by the upper proprietor. But the questions of fact which arise in determining whether a use is reasonable are limited by certain rules of law. One is that a permanent diversion of a substantial portion of the water, to the detriment of an owner below, can not be found to be reasonable, although it may be convenient and profitable for the diverter. It is an invasion of a legal right. In like manner the discharge of a noxious substance into the stream in such material quantity as to affect the purity of the water when it reaches the land of a lower riparian owner, if it interferes with his use of the water, is an invasion of his right of property and, as matter of law, is unreasonable. But in a use of a stream, of a kind which is generally recognized among the people and in the courts as legal, a slight impairment of the quality of the water, which is necessary and incident

to the use when properly and carefully regulated, is not unreasonable. These we think to be the rules that are deducible from the cases in Massachusetts and in other States.

In Red River Roller Mills *v.* Wright (30 Minn. 249), decided 1883, the plaintiff was the proprietor of a flour mill on Red River and sued the defendant, the proprietor of a saw and shingle mill above him on the stream, to enjoin it from discharging sawdust, bark, and other refuse into the stream, which refuse was carried down by the current and retarded the plaintiff in the operation of his mill. There was no question but that the only means of disposing of the sawdust and other refuse from the defendant's mill as it was constructed was by permitting it to fall into the stream over which the mill was built. On the other hand, it clearly appears that the plaintiff had sustained substantial injury from this refuse matter.

The trial court found that the defendant was only making a reasonable use of the stream, and refused an injunction. But the supreme court held that when it is shown that an upper riparian owner's use of a stream interferes with the reasonable use of the stream by a lower proprietor to the injury of the latter, it places the burden of proof on the upper owner to justify his use as a reasonable one—

* * * and the greater the injury is to the lower owner (said the court), the greater necessity for such use must the upper owner show in order to establish its reasonableness. The reasonableness of such use must determine the right, and this must depend in a great degree upon the extent of the detriment to the riparian proprietors below.

While the court conceded that the defendant had shown—

* * * that owing to the construction of buildings adjacent to said mill, and the formation of the land thereabout, there is no other available method of disposing of this refuse without rendering the mill, as it now stands and is constructed, useless as such.

But the court held the defendant should have gone one step further and shown that there was some necessity for locating his mill where it was located and that it was properly constructed.

* * * In the location and construction of his mill (said the court), defendant was bound to anticipate and have regard for any reasonable use to which others might or could put the stream. For anything that appears in the evidence, this mill could have been so constructed as to render the casting of this refuse into the water wholly unnecessary.

In this case the plaintiffs constructed their flour mill some two years after the defendant's mill was constructed, "but this fact does not give the defendant any extra or special rights in the matter," said the supreme court.

In a very important case in Maine in which a number of able counsel appeared on each side and in which an opinion of considerable length was written, the complainant was a manufacturer of

cotton goods, employing over a thousand persons, and the defendants were a number of manufacturers who discharged sawdust, edgings, shavings, refuse wood, and other débris into the stream and stopped the wheel and retarded the manufacturing operations of the plaintiff. The question of the reasonableness of the use of the stream by the defendants was discussed by the court as follows:

* * * Although they did not strenuously controvert the fact of the great damage to the complainants, they claim that what they do in thus disposing of their waste is but a reasonable use of this river. * * *

* * * Any diversion or obstruction which substantially and materially diminishes the quantity of water so that it does not flow as it has been accustomed to, or which defiles and corrupts it so as to essentially impair its purity, thereby preventing the use of it for any of the reasonable and proper purposes to which it is usually applied, is an infringement of the rights of other owners of land through which the stream flows, and creates a nuisance for which those thereby injured are entitled to a remedy. (Merrifield *v.* Lombard, 13 Allen 17.)

It is laid down by the courts that the general principles governing the use of running streams in respect to the diversion, obstruction, or detention of water must also govern in respect to the amount of waste resulting from the process of manufacture. The reasonable use in such cases depends upon the circumstances of each particular case. The law does not lay down any fixed rule for determining what is a reasonable use of the water of a stream by a riparian proprietor. For domestic, agricultural, and manufacturing purposes, to which every riparian owner is entitled, there may be, consistently with that right, some diminution, retardation, or acceleration of the natural flow. So in regard to the use of the stream for manufacturing purposes, there must necessarily be more or less waste which it would be impossible to exclude from it and which by no ordinary care or prudence could be prevented from falling into the stream. The reasonableness of such use of the water must determine the right, and this must be governed by the extent of detriment received by the riparian proprietors below. (See Hays *v.* Waldron, 44 N. H. 580.)

And it was held that the use made of the stream by the defendants was not reasonable and should be enjoined. (Lockwood Co. *v.* Lawrence, 77 Me. 297, decided Apr. 22, 1885.)

In Worthen & Aldrich *v.* White Spring Paper Co. (74 N. J. Eq. 647), decided June 10, 1908, defendant was engaged in the manufacture of paper from pure cotton and linen rags and its mill was located on the Yantacaw River about a quarter of a mile up the stream from the works of the complainants, who were engaged in the business of bleaching, dyeing, and finishing cotton cloths. Plaintiffs had a large bleacher and had expended in buildings and machinery approximately $500,000 and employed about 600 men. They required large quantities of pure water, and the plant was located because of the availability of the water supply from the stream. Complainant commenced to operate its mill shortly after its construction in 1895, and about 10 years later the defendant began to operate the paper mill. Almost immediately complainant experienced difficulty in its work, and an examination disclosed that this arose from small

particles of cotton fiber which adhered to the fabrics and made it necessary to subject them to new and distinct operations in order to remove them. This suit was brought for an injunction, and the principal question in the case was whether or not the defendant was making a reasonable use of the stream in discharging the waste material into it. The court said:

Any appreciable discharge, into a natural water course, of any noisome substance is within the prohibition of the law. In the case at bar the pollution consisted of placing in the stream large quantities of waste cotton fiber, the particles of which varied in length from one-thirty-second to three-eighths of an inch and at times the deposit was in such quantities as to be actually visible to the eye in the discoloration of the water of the canal and river and in the deposit of quantities of the same material on the ground forming the banks and beds of these waterways. And at other times it was deposited in such large quantities as to be visible in the tailrace and in the stream in floating flocks or lumps, and at other times it was deposited in large quantities upon the screens and other apparatus and devices which are placed by the complainant in the canal for the purpose of screening the water before it went to the complainant's bleachery. There is no question on the evidence of the deleterious character of the polluting material, nor of the fact that it appeared in the waterways above described in such quantities as to seriously damage the complainant in the enjoyment of its property, nor of the further fact that it appeared in the washing machine in the works of the complainant in damaging quantities, and at times to such extent as to compel the complainant to shut down portions of its works. This was not and is not either a reasonable or a lawful use of the water of the river, and at the time the bill was filed, in my opinion, the facts and circumstances warranted the complaint which the complainant made in the court.

A very important case is that of the Indianapolis Water Co. *v.* American Strawboard Co. (53 Fed. Rep. 970), decided 1893, where the plaintiff was a water company owning a system of water works constructed under statutory authority for supplying water, for domestic uses and for the extinguishment of fires, to the inhabitants of Indianapolis. The demurrer having raised the question of the relative rights of the parties as riparian proprietors and the reasonableness of the defendant's use of the stream, that question was discussed by Judge Baker as follows:

* * * Every riparian proprietor has the right to insist that the stream shall flow to his lands in the usual quantity and quality, and at its natural place and height. He owes the duty of permitting it to flow off his land to the lower riparian proprietor in its accustomed quantity, quality, place, and level. The proprietor has no property in the flowing water, which is not the subject of riparian ownership, but he may use it for any purpose to which it can be beneficially applied, without material injury to the rights of others. Any diversion or obstruction of the water which substantially diminishes its volume, or the depositing of any substances in the stream which corrupt or pollute the water to such a degree as essentially to impair its purity, and prevent its use for any reasonable and proper purpose to which running water is usually applied, is an infringement of the right of other owners of land through which the stream flows.

And the court pointed out in detail the allegations of the bill as to the nature and extent of the pollution and held that—

* * * the bill shows the wrongful corruption of pure and wholesome water, so that it has become offensive to sight and smell, and deleterious in use for ordinary domestic purposes. It clearly discloses an actionable wrong,

and overruled the demurrer.

AND THE FACT THAT A MANUFACTURER IS ENGAGED IN AN IMPORTANT INDUSTRY, THE OPERATION OF WHICH BENEFITS THE PUBLIC, WILL NOT BE HELD TO EXCUSE HIM FOR POLLUTING THE STREAM TO THE INJURY OF THE LOWER PROPRIETOR.

Thus in Indianapolis Water Co. *v.* American Strawboard Co. (57 Fed. Rep. 1000), decided 1893, the court said:

It is urged that the defendant is prosecuting a business useful in its character, beneficial to the public, and furnishing employment to a large number of men, and that it is conducted with skill and prudence, and with the most approved machinery, and, if damage results, it arises from no fault of the defendant, and that in such cases the ancient rigor of the law has been modified in furtherance of industrial progress and development. This contention finds no support, either in principle or authority. It is rudimentary that no man can be deprived of life, liberty, or property but by due process of law, nor can private property be taken, even for public use, without just compensation first having been made or received; and under no form of government having regard for man's inalienable rights can one be permitted to deprive another of his property without his consent and without compensation, on the plea that the injury to the one would be small, and the advantage to the other, or even to the public, would be great. This principle has its sanction in the consciousness and right reason of every man, and is asserted by the concurrent judgments of all courts which administer an enlightened system of jurisprudence.

In Silver Spring Bleaching and Dyeing Co. *v.* The Wanskuck Co. (13 R. I. 611), decided February 11, 1882, in which an injunction was granted against a woolen goods manufacturer who was polluting a stream by the means of dyestuff to the injury of a cotton goods manufacturer on the stream below, the court in speaking of the rights of a riparian owner said:

* * * he has a right to have the water pass his land in its natural pure state. Pollution, to be the subject of a suit, must of course be appreciable. And we feel bound to reaffirm the decision heretofore made in the case of Richmond Mfg. Co. *v.* Atlantic De Laine Co. (10 R. I. 106) and the principles there set forth.

But the respondent contends that while this might be very good law in former days, when we were simply an agricultural people, and the water was only used for drinking, domestic washing, and the watering of horses and cattle, there has been a complete change of circumstances; that we are largely interested in manufactures, and the wealth of the State depends mainly on their prosperity; and that the lesser use should give way to the more valuable use. * * *

The right of the riparian owner, be he farmer or mill owner, to have the water pass his land in its natural state and to a certain use of it as it passes, not, however, injuring it for the use of others, is just as much his property

as the land itself. This court can not alter the law. Nor can the legislature take this right from him any more than it can take his land. If needed for public use, the State can take this right upon making compensation. But they can not take it, or, which is in this case the same thing, the use of it, from one man and give it to another for private purposes, even on the latter's paying for it. That may be a matter of private agreement, but the State can interfere only to protect the rights of all parties, not to take them away.

And in Middlestadt *v.* Waupaca Starch and Potato Co. (93 Wis. 1), decided March 27, 1896, where it was urged that the public importance of the defendant's industry as a useful manufactory was a justification for the pollution of the stream by the discharge of waste into the stream to the injury of a lower owner, who was a farmer, inasmuch as he had but a few head of stock and owned land for only 100 rods along the river and the evidence did not show that he ever used the water for household purposes. The court said that—

* * * Any distance from the source of pollution, nor public convenience, nor difficulty in voiding the trouble can neither justify nor excuse the wrong.

The same principle was upheld in Weston Paper Co. *v.* Pope (155 Ind. 394; 56 L. R. A. 899), decided June 22, 1900, where the defendant paper company contended its business was a lawful one, and that it was absolutely necessary for it to discharge its waste into the stream, even though it injured the plaintiff, a farmer and lower proprietor, who utilized the stream for domestic purposes and watering stock.

To the same effect is the case of Lockwood Co. *v.* Lawrence (77 Me. 297), decided April 22, 1885, where the court said:

* * * However great these industries or however important to either may be the result of this suit, the rights of the parties to the use of the water in that river are established by well-settled principles.

And in Holsman *v.* Boiling Springs Bleaching Co. (14 N. J. Eq. 335), decided 1862, it was said:

* * * Much evidence has been offered (I do not say improperly), on the one hand, to show the great value of the complainants' property and the variety of purposes—necessary, convenient, and ornamental—to which the water of the stream is applied; and, on the other, the extent and value of the defendants' manufacturing operations and the benefit thereby conferred upon the community in which they are located. These are considerations which naturally do, and which perhaps in some cases may legitimately, influence a court of equity in the exercise of its discretion. But these considerations can exercise no influence in the determination of the present case. The legitimate ground for the allowance of the injunction is not so much the intrinsic value of the property sought to be protected as its essential character and its importance to the complainants. The injunction is allowed, not upon the ground that the complainants' premises are occupied by a family of wealth and taste; that the water is used for supplying fish ponds, and fountains, and conservatories, and other purposes of ornament, taste, and luxury, but because the wrong complained of deprives the complainants of one of the essential elements of

life, because it seriously interferes with the daily health, comfort, and enjoyment of the family, and because the injury, in its essential character, is one for which no damages which a jury may give can compensate.

And in this view the injunction should freely issue to protect the humblest cotter who complains against the pollution of the spring at his cottage door, from which his family derives their daily supply of water for domestic use.

To the same effect is the case of Penn American Plate Glass Co. *v.* Schwinn (177 Ind. 645; 98 N. E. 715), decided May 28, 1912.

In Hill *v.* Standard Mining Co. (12 Idaho, 223), decided April 12, 1906, defendants were sued for damages for discharging débris and poisonous substances, lead and arsenic, etc., into the stream, to the injury of the plaintiffs, who were ranch owners. The defendants strenuously urged that the importance to the community of the mining and milling business was such that the doctrine of the Sanderson case should control, but in overruling the demurrer of the defendants the majority opinion denied the force of the contention and said:

The law does not measure the rights of litigants by the amount involved, nor the manner in which it may affect others not parties to the litigation.

In a concurring opinion Justice Ailshie held that the pollution of the stream by poisonous substances, etc., was justified by the nature and necessities of the mining business, but that it did not justify the defendants "in wrongfully dumping and depositing rock, earth, sand, and waste material into the stream and filling up the natural channel of the stream, and thereby causing the same to wash over and upon the lands of the plaintiff." The dissenting opinion follows the reasoning of the Sanderson case in permitting the development of natural resources with due care without liability to the lower owner injured thereby.

IT HAS BEEN HELD THAT EVEN WHERE A LOWER PROPRIETOR CAN, AT COMPARATIVELY SMALL EXPENSE, PROTECT HIMSELF AGAINST THE INJURY CAUSED BY AN UPPER PROPRIETOR ENGAGED IN AN IMPORTANT BUSINESS, HE IS NOT BOUND TO DO SO.

Thus in Richmond Manufacturing Co. *v.* Atlantic De Laine Co. (10 R. I. 106), where defendants urged the large importance of their business and the fact that the plaintiff could at small expense prevent the injury by installing a filter, the court said:

And it is no defense to say that the complainants could have filtered the water at no great expense. The complainants are under no obligation to do this, and the respondents have no right to put them to the expense of doing it.

And in Stevenson *v.* Coal Co. (200 Pa. 316), which was a suit for damages resulting from refuse matter emptied into the stream by mines to the detriment of the lower proprietor, the court said:

* * * As to the sixth assignment, appellants offered evidence to prove that plaintiff could procure pure water from another source. This testimony the court rejected. We said in the former opinion in this case, that plaintiff "had the right to use this water as it naturally flowed over his own property,"

and that his right to decline the use of any other water was just as absolute as to enjoy his own unpolluted. We can not see how such evidence could be used in mitigation of damages for infringement of an undisputed right. No wrongdoer can trespass on the right of a citizen and mitigate his wrong by saying, "You can secure as valuable a right elsewhere."

The same case had been before the court before and the court had said:

* * * There was no error in rejecting the offer to prove that the Nescopeck Water Supply Co. would agree to supply fresh water to the plaintiff at the rate of $15 per annum, in an amount sufficient to wash the wool in his factory. He had the right to use the water of Nescopeck Creek as it naturally flowed over his own property, and private parties polluting it can not urge, in mitigation of the damages they cause, that they offered to give him a substitute for it. The right to arbitrarily decline the use of any other water proffered by the defendants was as absolute as the right to use his own unpolluted water, and the tenth assignment is overruled. (201 Pa. 123.)

And in Brown *v.* Gold Coin Mining Co. (48 Oreg. 277, 86 Pac. 361), decided July 24, 1906, where plaintiff sued for an injunction to prevent the defendant from emptying pulverized ore into the stream flowing through plaintiff's premises and where it was contended that the plaintiff might have obtained water for his stock and for domestic purposes from other sources, the court granted the injunction and perpetually restrained the defendant "from the further operation of its mill until it has made suitable provision to prevent injury to plaintiff's irrigating ditches, and to the water used by him from the creeks for household and for stock purposes," saying as to the contention of the defendant above indicated:

* * * The plaintiff, being a riparian proprietor on Rith Creek, was entitled to have that stream flow through his premises undiminished in quantity, except as to the reasonable use thereof by other like proprietors, and unimpaired in quality, and because he might possibly secure water for his family and for his stock at other places on his land than the streams mentioned, does not impose on him the duty of resorting thereto to supply his needs, in order that a quartz mill may be operated * * *.

In that case, however, the plaintiff's predecessor in interest had made a prior appropriation of the water.

In Elliott et al. *v.* Ferguson (37 Tex. Civ. App. 40), where plaintiffs sued for an injunction against the locating of a cemetery at a point where it was claimed that drainage would flow from it, to the injury of their wells, and where such an injunction was granted, defendant, on appeal, argued that the trial court had erred in refusing an instruction to the jury to find which of their wells would be injured by the proposed cemetery. It was the contention that only two of the plaintiffs would have been injured as to their wells, and that these two could have been supplied with wooden cisterns at a cost of $30 each, and that therefore the estab-

lishment of the cemetery should have been permitted. The court said:

> We can not consent to this contention. The plaintiffs have the right to the unrestricted use of the water furnished by their wells and springs, and the law ought not to compel them to abandon or restrict such use and adopt another and different water supply in order that the defendants may use their property for cemetery purposes.

And in Penn American Plate Glass Co. *v.* Schwinn (177 Ind. 645; 98 N. E. 715), decided May 28, 1912, the court said:

> Nor can the riparian owner below be required to protect himself.

In the case of Snow *v.* Parsons (28 Vt. 459), decided 1856, the court had before it the question of whether testimony as to the custom of discharging tan bark into the stream was admissible in a suit for damages against the defendant, the proprietor of a tannery, brought by the plaintiff, a lower riparian proprietor owning a sawmill on a branch of the Deerfield River. The plaintiff had recovered damages in the lower court, but the supreme court reversed the lower court upon the ground that the testimony regarding custom should have been admitted. Defendants had shown that there had been no inconvenience caused to plaintiff until his installation of a new type of wheel; that the tan bark had not interfered with the wheel that he had formerly used; and it appeared that the wheel in use "might have been altered without impairing its usefulness, and at a small expense, so that the tan bark would not impede or affect its operations."

The Vermont Supreme Court, in holding that the reasonableness of the use was the test of liability, said:

> This must be determined upon general principles applicable to the entire business of tanning, and the importance of discharging its waste materials in this mode, and the probable inconvenience of those below. And if in this view they regard the use as an unlawful one, then surely the defendants are liable to all damage sustained by the plaintiff, whether he might have used a wheel less liable to injury or not.
>
> But if the use is fairly to be regarded as a lawful one, then probably the plaintiffs should have conformed their machinery to the altered circumstances of the stream. And if the defendants' use of the stream is a lawful and allowable one it will make no difference that the plaintiff's mill was first erected if it had not been in operation a sufficient length of time to acquire any prescriptive right to use the water in an extraordinary manner. And as the plaintiff's present wheel was put into his mill after the defendants' tannery was in operation and his other wheel would not have been unfavorably affected by bark nothing by way of prescription or license or prior occupancy can probably be claimed.

Later the same court had the question of the duty of a lower proprietor to protect himself more directly before it. In Jacobs *v.* Allard (42 Vt. 303) the complainants, who owned a starch factory,

sought to enjoin the defendant, a sawmill proprietor on the stream, above complainants, from discharging sawdust, shavings, and waste from his shingle mill and from placing the sawdust on the bank so that it washed into the stream. The effect of this discharge into the water was claimed to render it impure and unfit for making starch, to clog the flume and penstocks of the complainants, and to prevent the proper operation of the starch factory. It was alleged that this was done with an intent to injure the complainants. The court failed to find any evidence of wrongful intent on the part of the defendant and said:

In the first place the evidence makes a rather strong impression on our minds that much of the trouble which the orators claim, and give evidence to show, that they experience in the condition of the water as it comes to their works is attributable to the manner in which they have constructed and adjusted a new dam in reference to their works and to the lack of proper fenders and strainers to protect against impurities that may get into the stream from the mills and works above the orators. It would seem that by proper modes and means which they could, without unreasonable pains and expense, have adopted and put in use, the troubles complained of while the defendant was using his shingle mill and letting the sawdust and waste from it go into the stream.

And the court denied injunctive relief and dismissed the bill with costs. There is nothing in the opinion to indicate what the expense to the defendant of installing the fenders and strainers would have been, except the general expression that it could have been done "without unreasonable pains and expense."

In the case of Barton *v.* Union Cattle Co. (28 Nebr. 350, 44 N. W. 454, 7 L. R. A. 467) it was contended that the plaintiff, a farmer on Papillon Creek, ought not to have injunctive relief against the defendant, a cattle company, which ran a sewer into the stream and so polluted it as to render it unfit for agricultural purposes, etc., upon the ground that the plaintiff, by an initial expenditure of a few hundred dollars and by small annual expenditures, might provide means of watering this stock without resorting to Papillon Creek, the watering of stock being the principal purpose to which the stream was devoted by the plaintiff. The court denied that such an alternative furnished a sufficient reason for denying an injunction. The court discusses the case of Jacobs *v.* Allard, *supra*, and, in distinguishing it, said:

The distinction between the above case and the case at bar in respect to the remedy suggested is that in the one case it is a prevention of the effect of the pollution, and in the other it contemplates the enduring of the effect of the pollution of the stream, but suggests the creation of an artificial watercourse to supply plaintiff's land, and contemplates the abandonment of the stream, which is the subject of the litigation. The difference, as it seems to me, is radical in principle, and I do not think that the comparatively small cost at which plaintiffs

might be able to supply water for their cattle from an independent source can be considered in connection with their right to have the stream remain uncontaminated in the manner shown by the pleadings and bill of exceptions.

A further distinction, which the learned justice might have made and which may be of some significance, is the fact that in the Vermont case both the plaintiff and the defendant were utilizing the stream for industrial purposes, and no natural or domestic or agricultural use of a lower riparian proprietor was involved, whereas in the Nebraska case the plaintiff was using the stream for natural purposes, and although the defendant was likewise utilizing it for such purposes in a certain sense, yet its use was so extensive as to have lost the protection of the rule in favor of natural uses.

But the Supreme Court of Ohio has denied injunctive relief to a plaintiff where the injury sustained could be obviated, although only by the utilization of a water supply other than the stream polluted by the defendants.

In the case of Salem Iron Co. *v.* Hyland (74 Ohio, 160), decided April 3, 1906, the plaintiff was the owner of a tract of 48 acres of land, and for some 35 years had operated thereon a blast furnace for the manufacture of pig iron. There were also dwelling houses occupied by employees of the plaintiff and their families, and a portion of the land was used for pasturage. Cherry Fork of Beaver Creek ran through the land, and in its natural state the water was practically free from impurities and was suitable for the generation of steam, the plaintiff utilizing some 200,000 gallons of it daily for that purpose. The defendants had discovered a valuable bed of petroleum near the source of Cherry Fork, and above the plaintiff's premises, and were operating it "in the usual way and without negligence by pumping the oil and the salt water, with which it is always commingled in the Ohio field, into tanks, permitting the oil to rise to the surface and drawing the salt water from beneath it, the water finding its way by gravity to the stream. No other mode of operating for petroleum is known." While the bill alleged that the operations of the defendants not only rendered the water unsuitable for use in the boilers but also in times of overflow injured the pastures on the plaintiff's land, the opinion of the supreme court does not mention any damage to the pastures, so that it must have found that there was no evidence to sustain that allegation of the bill. As to the impairment of water for use in the boilers, the court said:

The extent to which the water of the stream is charged with salt when it reaches the property of the plaintiff varies with the stage of the water in the stream, but it is at all ordinary stages sufficient to increase the foaming of the water in the boilers when heated, to raise its boiling point, to increase the demand for fuel for the generation of steam and to diminish perceptibly the effi-

ciency of the furnace. It is practicable for the plaintiff to obtain water for the furnace at other and convenient sources at a moderate and ascertainable expense, and the addition of a small amount of oil to the water of the stream after it receives the water of the oil wells of the defendants would materially diminish the foaming and lower its boiling point.

It is impossible for the defendants to develop the mineral resources of the land without doing all the things with which they are charged.

The opinion does not indicate what the "other and convenient sources" of supply of water available to the plaintiff were.

The court said:

The single question for our determination is whether, upon such a state of facts, a court of equity should perpetually enjoin the prosecution of the enterprise of the defendants in view of the injury which it unavoidably inflicts upon the plaintiff.

And held that the pollution of the stream by the defendant was not a taking of property, but that at the most it was only a nuisance and that courts of equity should not enjoin a nuisance where the remedy at law is adequate, and said:

This is not an action for damages. The defendants are conducting a lawful business with care. They are conducting it at the only place where it can be conducted. Such injury as is done to the plaintiff is unavoidable. No injury to the health of the public or the employees of the plaintiff results. If the conduct of the defendants is without right, and a more appropriate rule of damages should not be suggested in an action at law, the recovery of a sum of money sufficient to pay the expense of obtaining water from another source would fully indemnify the plaintiff and relieve it of further injury without additional litigation. Cases which take no account of considerations, such as these, are not in harmony with the beneficent purposes for which the system of equity was established.

There is no such thing as an equitable nuisance. If the plaintiff has no cause of action at law in the present case, it can have none in equity, and the jurisdiction of the courts of equity must be determined by the usual test respecting the adequacy of the legal remedy. That nuisances are frequently enjoined results from the fact that they are frequently, if not usually, of such a nature as to present one of the recognized grounds of equitable jurisdiction—that is, that the injury is irreparable by the processes of the law or that a multiplicity of suits would be required at law to obtain redress.

The case does not require us to consider whether the plaintiff may recover at law or whether in a case otherwise within the grounds of this form of relief an injunction should be denied because less injury would result to the plaintiff from denying than to the defendant from allowing it.

It will be noted that the facts upon which the opinion of the court rested did not include any question of the rights of the lower proprietor utilizing the stream for natural purposes, the proof apparently having failed in regard to the damage to the pasturage. It would seem that the reasoning of the court, by which its conclusion is reached, is that the legal remedy is complete and adequate in that it is open to the plaintiff to sue and recover the amount necessary for the installation of the system for obtaining water from another source of supply, would not apply to a case where the riparian owner

actually utilized a stream for agricultural purposes, such as the watering of cattle, etc.; in other words, the holding is not necessarily opposed to that of Barton *v.* Union Cattle Co., supra.

The case is, however, irreconcilable with the holding in Parker *v.* American Woolen Company, and other cases, to the effect that a right will be protected by injunction, although no present use of the stream is being interfered with. Obviously the reasoning upon which the Ohio decision rests takes no account of the possible uses to which the stream might be devoted and it would seem to be hardly possible in any case to determine whether or not an alternative source of supply would be available which would fulfill all of the possible uses to which the stream might in its pure state have been devoted.

One is forced to the conclusion that the necessities of the defendants in the Ohio case had great weight with the court and that in its desire to do justice in the particular case, a conclusion was reached which may prove an annoying precedent for future cases.

THE DOCTRINE AS TO MINING USES ANNOUNCED IN THE SANDERSON CASE, FOLLOWED ONLY IN PENNSYLVANIA AND INDIANA, AND EXPRESSLY REPUDIATED ELSEWHERE.

While the holdings are substantially unanimous to the effect that nanufacturing concerns causing material pollution are not making ı reasonable and lawful use of the stream, a distinction is made by ome courts as to utilization of the stream by mining concerns and he like. This doctrine had its origin in the case of Pennsylvania Coal Co. *v.* Sanderson (113 Pa. 126; 57 Am. Reps. 445). In that ase the plaintiff was a lower proprietor who had purchased a piece of property on a clear, pure stream of running water after considerable investigation of the quality of the water of the stream and eing largely influenced by its excellence. Plaintiff had built a home, onstructed fish ponds, and installed an elaborate pumping system y which the water of the stream was utilized for domestic purposes. After this expense had been incurred the defendant company, ngaged in the business of mining coal, caused the water from its ines to be pumped out and to flow into the stream. The water hus brought into the stream was of such character and quantity as o seriously pollute it. It killed the fish in the plaintiff's pond, endered the water useless for domestic purposes, etc. The suit was rought for damages and an injunction. The case was twice decided ı plaintiff's favor in the Supreme Court of Pennsylvania, but was rought before that court a third time, and four judges out of seven eld that the plaintiff was entitled neither to damages nor an njunction. The decision of the court rested upon two grounds, either of which had been generally regarded as sound by other ourts: First, that in pumping water from its mines so as to cause

it to enter a stream running through its property the defendant was making a natural use of the stream; and, second, that the vast importance to the community and the State of the coal-mining industry required the plaintiff to give up her less important use of the stream for domestic purposes, and without compensation.

The holding of the Pennsylvania court on each of the above propositions has been severely criticized, and the case has not been followed, except in Indiana.

In Beach *v.* Sterling Iron & Zinc Co. (9 Dick. (N. J.) 65) the court says of the Sanderson case that—

> It has not, so far as I know, been followed in any other court, certainly not in this State.

And in distinguishing mining from natural uses said:

> The argument was advanced by the defendant that the use of the defendant's property for mining purposes is what was termed—unfortunately, I think—by Lord Cairns, in Fletcher *v.* Rylands (L. R. 3 H. L. 330, at pp. 338, 339) (1868), a natural user, and similar in that respect to plowing a field; and that if it be unlawful for defendant here to cast into the stream the muddy waters from its mine it is also unlawful for the farmer to plow his land and allow the muddy water which runs from it after a heavy rain to reach the river. But the very statement of the two cases shows the absence of analogy between them. In the first place, the water from the plowed field comes thereon by natural causes beyond the farmer's control and runs by gravity to the stream, while in the case of the mine the water is, as here, found and raised by artificial means from a level far below that of the river, and would never reach it but for the act of the miner; and, in the second place, by the common law of the land every owner may cultivate his land without regard to its effects upon his neighbor, while such is not the law as to mining. The Supreme Court of Ohio, in Columbus Co. *v.* Taylor (48 Ohio, 41, at p. 58), repudiates the notion that mining was a natural use of the land in the sense that farming is.

In H. B. Bowling Coal Co. *v.* Ruffner (117 Tenn. 180; 100 S. W. 116; 9 L. R. A. (N. S.) 923; 10 Ann. Cas. 581), decided February 19, 1907, in which the lower proprietor, a farmer, owning a sawmill and grist mill on a stream, was injured by a mining company which pumped water which found its way into the stream so as to pollute it, and where the coal company insisted that it was only making a natural use of the stream and was entitled to a natural and reasonable enjoyment of its property, and hence was not liable, the Tennessee Supreme Court said:

> * * * While the principle invoked is well recognized, it has no application to the facts presented in the present record. The facts disclosed herein show that the mine water causing the pollution of the stream did not escape from the mine during the lawful progress of the work and find its level by the laws of gravitation in the stream so contaminated. But it affirmatively appears that the mine owner, in order to benefit himself, deliberately collected the mine water in pipes, and, conveying it through the mine and to a distance

of 75 feet beyond its mouth, emptied it into the stream or tributary flowing into the East Fork of Little Emory River, so that it is perfectly apparent that the injury sustained by the plaintiff below was not the inevitable consequence of a natural use and enjoyment of the defendant's property, but was the result of the artificial collection and disemboguement of poisonous waters into a stream where the plaintiff was enjoying his undoubted riparian rights.

The defendant company appears to have relied upon the authority of the Sanderson case; but the Tennessee Supreme Court, after remarking that that case had twice been decided the other way before the ultimate decision, said:

* * * In commenting on this case it is unnecessary to do more than quote the words of Lord Shand in Young *v.* Bankier Distillery Co. (1893) (A. C. 691, 700): "In that case undoubtedly the court held that the owners of a mine were entitled to pump up water from the lower strata of the mine and to send it into an adjoining stream, although the quantity of the water was thereby increased and its quality so affected as to render it totally unfit for domestic purposes by the lower riparian owners." The case had been twice previously before the court, and on both occasions the judgment was given against the mine owner. On the third occasion, which occurred in consequence of a third trial to assess the damages, the jury found a very large sum due to the lower owner; but the verdict was quashed and the whole case reconsidered with reference to the legal rights of the parties, and with the result I have stated. In a court of seven judges there were three who dissented from the judgment, including the chief justice of the State. This circumstance and the grounds of the judgment seem to me to be sufficient to deprive the case of any real weight. These grounds appear to me, from a perusal of the judgment, to be fairly stated in the headnote, as follows: "The use and enjoyment of a stream of pure water for domestic purposes by the lower riparian owners, who purchased their land, built their houses, and laid out their grounds before the opening of the coal mine, the acidulated waters from which rendered the stream entirely useless for domestic purposes, must ex necessitate give way to the interests of the community in order to permit of the development of the natural resources of the country and to make possible the prosecution of the lawful business of mining coal." I shall only add that while the enormous value of the mining interests in the district of Pennsylvania, from which the case came and which is fully explained in the judgment, might have formed a good reason for appealing to the legislature to pass a special measure to restrain any proceeding by interdict at the instance of surface proprietors and to confine them to a right to damages only for injury sustained, that value could, in my opinion, afford no good legal ground for allowing the proprietor of a mine so to work his mines for his own profit as to destroy or greatly injure his neighbor's estate by subjecting it, by means of artificial operations, to the burden of receiving water enlarged in quantity and destroyed in quality without payment of compensation or damages for the injury done. The case has no application to the present, because the decision was based on special circumstances as to the great relative value of the minerals as compared with the surface in the district, and because in any view the decision seems to me to have been making law rather than interpreting the law, so as to give effect to the sound, just, and well-recognized principles as to the common interest and rights of upper and lower proprietors in the running water of a stream.

And in Strobel *v.* Kerr Salt Co. (164 N. Y. 303), decided 1900, the Court of Appeals of New York said:

> * * * Courts of the highest standing have refused to follow the Sanderson case (Columbus, etc., Co. *v.* Tucker, 58 Ohio St. 41; Beach *v.* Sterling Iron & Zinc Co., 54 N. J. Eq. 65; Young *v.* Bankier Dist. Co., L. R. App. Cas. 1893, 691); and its doctrine was finally limited by the court which announced it (Robb *v.* Carnegie, 145 Pa. St. 338). The court below, however, manifestly followed the Pennsylvania rule without limitation (Mann *v.* Retsof Mining Co., 49 App. Div. 454, 459). We have never adopted that rule in this State and no public necessity exists therefor, even if it would ever warrant the courts in relaxing rules for the protection of property of small value in the interest of some business required to develop the resources of the State, and in which much capital had embarked, giving employment to a great number of people.

The holding was also condemned in State of West Virginia *v.* Southern Coal & Transportation Co. (71 W. Va. 470, 76 S. E. 970; 43 L. R. A. (N. S.) 401).

And in Columbus & Hocking Coal & Iron Co. *v.* Tucker (48 Ohio St., 12 L. R. A. 577), decided January 13, 1891, the court said:

> We are admonished that the case is one of great practical importance.

And said:

> We agree that the case is an important one, and, recognizing this, the court has given to it full and patient consideration.

It was strenuously urged in that case that the defendant, engaged in mining coal, ought to be excused from liability to the plaintiff, a lower proprietor upon whose land slack and refuse from the coal mine was deposited, because of the importance of the defendant's business to the community and the fact that it was developing a natural resource, etc. But the court said:

> Nor is it of consequence that the operation of the company's mines tends to the development of the natural resources of the country. But few enterprises, the product of which is useful, fail to advance the general good. Along with many evils attending the working of this class of organizations, valuable services have been rendered to the public by them and many comforts and necessaries are afforded the people by them which the capital of single individuals would be inadequate to produce. At the same time they are not, in the eye of the law, public enterprises, but, on the contrary, are organized and maintained wholly and entirely for private gain, and so soon as gain ceases to follow their operation, just so soon do the operations themselves cease.
>
> * * * The further claim of the company that it had the right to make the deposits in the places complained of because it was necessary to the successful conduct of its own business to so place them, seems no less wanting in substance. The effect is to measure the rights of the plaintiff in his lands and in the waters of Monday Creek by the convenience or necessity of the company's business. An owner of land in Ohio is not subject to any such narrow and arbitrary rule.

In Drake *v.* Lady Ensley Coal, Iron & R. Co. (102 Ala. 501, 24 L. R. A. 64), plaintiff, a farmer, sued for damages for injuries resulting from the pollution of the stream flowing through his premises

and utilized by him for watering stock, etc., and at times for drinking purposes. The defendant was an upper proprietor who pumped large reservoirs of water from the stream, utilized it for washing its ore and returned it to the stream, thus causing the pollution complained of. The defendant contended that the injury was damnum absque injuria because of the importance of the industry in which it was engaged and that the plaintiff's right ought to be yielded to the larger and paramount good. The Sanderson case was relied upon, but the Alabama Supreme Court refused to recognize this contention and, in the opinion by Mr. Justice Coleman, said:

> Under the provisions of the Constitution, private property can not be taken for public uses, or for corporations without just compensation being first made to the owner, except by his consent. The courts—and it was never intended to be otherwise understood—are not the "masons" to "chisel" away vested rights of property of private individuals, however humble and obscure the owner, for the benefit of the public or great corporations. It is the pride of this Republic that no man can be deprived of his property without due process of law, and the poorest citizen can find redress for an unlawful injury caused by his wealthy neighbor by appealing to the courts of his country.

But there has been, perhaps, some slight yielding to the doctrine in Alabama. In Tennessee Coal, Iron & R. R. Co. *v.* Hamilton (100 Ala. 252), decided 1893, plaintiff recovered damages against the defendant arising from the pollution of the stream caused by the washing of ore in water which was taken from the stream and then allowed to flow into it again. The case was sent back for a new trial largely on the ground that testimony was excluded which would have gone to show that others were washing ore in the same stream and that not all of the injury which the plaintiff sustained was caused by the defendant. The injury sustained by the plaintiff appears to have been quite serious and the court seems to have recognized that there was a right to recovery. Fish had been driven from the stream, sediment deposited in the stream which caused it to overflow its banks, and plaintiff had been required to take her cattle to another water supply for water and had suffered other inconveniences.

The court, while not indorsing the doctrine of the Sanderson case, quotes from an earlier decision of that case (86 Penn. St. 401) to the effect "that the exigencies of great industrial industries must be kept standing in view," and the Alabama court then says:

> It is certainly true that owing to the wants, if not the necessities of the present age—of agriculture, of manufactures, of commerce, of invention, and of the arts and sciences—some changes must be tolerated in the channels in which water naturally flows and in its adaptation to beneficial uses. Reasonable diminution of its quantity in gratifying and meeting customary wants has always been permitted. So its temporary detention for manufacturing purposes, followed by its release in increased volume, is a necessary conse-

quence of its utilization as a propelling force. Nor must we shut our eyes to the tendency—the inevitable tendency of these and other uses in which water is an indispensable element to detract somewhat from its normal purity. The modifications of individual right must be submitted to in order that the greater good of the public be conserved and promoted. But there is a limit to this duty to yield, to this claim and right to expect and demand. The watercourse must not be diverted from its channel or so diminished in volume or so corrupted and polluted as practically to destroy or greatly impair its value to the lower riparian proprietor. Sic utere tuo in such conditions is enjoined by social obligation and by law. It is difficult, if not impossible, to declare a rule in language so clear and precise as that it can be applied with certainty to every case that may arise. (See Miss. Mills Co. *v.* Smith, 69 Miss. 299.)

And in Williams *v.* Haile Gold Mining Co. (85 S. C. 1, 66 S. E. 117), decided November 23, 1909, wherein an action brought by a farmer against a gold-mining company, who sued and recovered damages and obtained an injunction, the defendant company set up the importance to the community of its business and its justification to the pollution. The Supreme Court said:

* * * It has been too frequently held by this court to require further discussion that when the existence of a nuisance has been established by the verdict of a jury the party injured is entitled as a matter of right to an injunction to prevent its continuance. (Threatt *v.* Mining Co., 49 S. C. 95, 26 S. E. 970; Mason *v.* Apalache, 81 S. C. 554, 62 S. E. 399, 871.) Whatever may be the doctrine in other States under the provisions of the constitution of this State that private property shall not be taken for private use without the consent of the owner, the court could not have considered, in deciding whether to grant or refuse the injunction, the question raised by the defendant as to the balance of convenience or of advantage or disadvantage to the plaintiff and defendant and the public at large for the defendant's use of the stream. That question would be pertinent only in an application addressed to the legislature to give such corporations the power of condemnation. (Boyd *v.* Granite Co., 66 S. C. 433, 45 S. E. 10.)

And the doctrine of the Sanderson case would seem unsound upon principle no less than upon authority. Manifestly the tendency of the doctrine is to render riparian rights unstable and uncertain. For example, just what degree of importance must an industry attain before it can claim the right to pollute a stream to the injury of a lower proprietor? Again, how necessary must the pollution be to the success of the enterprise; that is to say, suppose that the pollution could be prevented, but only by preventive measures involving additional expenditure? How little or how much effort with such preventive measures will the court require before permitting the property rights of lower proprietors to be destroyed? Again, are the rights of all lower proprietors within the rule laid down or only such lower proprietors as make use of the stream for domestic purposes, and if lower proprietors who utilize the stream for industrial purposes are to be compelled to give way to any interest of

industries of larger importance how is the relative value of the two industries to the community to be weighed? By the number of men employed by each and the value of the output of each at the time suit is brought? Or by the estimated extent of their operation at some future time?

It would seem that the rights of an individual in utilizing the stream for domestic purposes would stand upon at least as high a ground as similar rights made use of for industrial purposes, and that if the right could be destroyed in one instance, it could in both.

These are some of the considerations. It would seem to indicate that the Supreme Court of Pennsylvania has assumed a large responsibility, and it is not strange that the courts of other States have refused to follow the decision.

The difficulties which a concrete case may present are well illustrated in the opinion of the Supreme Court in Commonwealth *v.* McCormick (172 Pa. 506), decided 1896. In this case, upon the relation of the Butler Water Co. the attorney general of the Commonwealth brought a proceeding against the defendant to prevent it from polluting the water of Connoquenessing Creek. The defendant was engaged in the production of oil above the source of supply of the water company on the stream and in its operation pumped to the surface a fluid composed of 2 per cent oil and 98 per cent water. The oil was allowed to rise to the surface and was separately conducted off. The water, which contained a large amount of salt, was poured out upon the ground and by gravity came into the streams leading to Connoquenessing Creek, which was the sole and only source which the Butler Water Co. had utilized for its water supply. The water had been pure and wholesome and fit for domestic use about nine months out of each year before the defendants commenced their works, but for the remainder of the year it had been unwholesome. The lower court refused an injunction and followed the Sanderson case in holding that in view of the importance of the defendant's business it ought not to be interfered with to the serious extent which would follow an injunction. The Supreme Court held that were it not for the public nature of the water company this decision of the lower court would have been correct, but pointed out that the water company was engaged in a public business and that the supply it furnished "affected the health and comfort of thousands of citizens." The case was sent back for a new trial, the court stating that additional findings of fact should be made before a correct conclusion could be reached. (The findings of fact were somewhat numerous and occupied several pages in the printed report.) The court said:

* * * Among other subjects to be examined and passed upon are these: What was the situation of the valley or basin of the Connoquenessing when the

water company appropriated the stream for the supply of Butler borough? Was it at that time a developed oil field or not? At what date did the pumping of salt water into the stream begin? What is the value of the daily or monthly output of oil by the defendants from their wells? What would be the approximate cost of conducting the salt water either by surface drain or by pipes to some point below the plaintiff's dam? Can the salt water be relieved of its salt by subsidence or filtration by the operator before turning it into the stream, and if so at what expense? Can the water of the stream be so cleansed by the company and at what expense? Can the plaintiff command a sufficient supply of water by going above the defendant's wells for it, and could they then obtain pure water? If so, what would be the probable cost of such a change in the plant of the water company?

When the case has thus been fully heard on its facts the questions we have suggested can be considered * * *

Clearly the doctrine of the Sanderson case places upon the Pennsylvania Supreme Court grave responsibilities.

In Alabama the Supreme Court refused an injunction against a mining company, which the court judicially noticed was engaged in the business of very great importance to the State and said that the defendant should be remitted to an action at law for such damages as he could show. There were, however, other elements in the case which the opinion indicates were somewhat pursuasive to the conclusion reached. For instance the court does not appear to have been satisfied that there was any real material injury to the defendant. The court said:

The only asserted use made of the creek by appellee, prior to the erection of the "washers," was for fishing, bathing, and watering a few horses, cattle, and hogs. * * * It is not shown that, since these washers were erected, appellee has suffered any material injury or been deprived of the means of giving water to his horses, cattle, and hogs.

And it was also found that a town was discharging its drainage into the stream and the court apparently assumed that this could not have been prevented by an injunction, and the pollution caused by the drainage of the town being inevitable, the court seems to have doubted the efficacy of an injunction against the mining company. Probably, therefore, the decision can not be laid hold of as a reliable authority for the proposition that an injunction will be refused out of deference to the importance of the industry causing the pollution. It would seem upon principle that such a doctrine would be but slightly less dangerous than that of the Sanderson case, for clearly the real effect of such a holding is to give the power of eminent domain to one upon whom the legislative authority has not seen fit to confer that power.

The right of eminent domain is derived from legislative authority. The courts generally have recognized the rights in a stream as property rights. It would seem to follow logically that such rights ought not to be permitted to be taken away except in case of the clearest

public interest recognized by the legislative authority. It will not do to say that the right is preserved to the lower owner through his right to recover damages. Damages are not always ascertainable with exactness, and even if they were, the proposition would still involve a forced sale of a property right which the owner might not choose to sell. Indeed the difficulty of estimating the money value of the right to a natural flow of a stream is one of the reasons why injunctive relief against a continuing pollution is recognized by the courts. The difficulty of assessing damages is always present and argues most strongly against relegating the injured owner to an action in damages.

The Supreme Court of Ohio, nevertheless, appears to have taken the position that where natural resources are being developed an injunction against pollution may be refused if the injury does not amount to an appropriation of the lower proprietor's property although the court strenuously opposes the doctrine of the Sanderson case and refuses to deny to the lower owner a right to recover his actual damages. In Straight *v.* Hover (79 Ohio St. 263), at page 278 it was said:

> * * * where the invasion of the rights of the lower proprietor does not amount to an appropriation of his property, but merely constitutes a nuisance, an injunction will not be allowed to prevent the development of the resources of the lands of the upper owner, but that an action will lie for the recovery of such substantial damages as the lower proprietor may sustain by reason of such operations. With that position we are content since it seems to regard all the principles which the rights of the parties require us to recognize.

It is believed, however, that most of the cases in which an injunction has been denied were cases in which there was present an element of laches or estoppel. In the case of the City of New York et al. *v.* Samuel Pine, et al. (185 U. S. 93, 46 Lawyers Ed. 820), the city of New York erected a dam on the Byram River for the purpose of obtaining water to supply the city of New York. The dam interfered with the flow of the water in the lower part of the stream in the State of Connecticut to the alleged injury of defendants in error.

The suit was brought in the circuit court for the southern district of New York, and an injunction was granted precluding the city from diverting the water as planned. The case was affirmed by the circuit court of appeals by a divided court and brought to the Supreme Court by certiorari. The Supreme Court reversed the case, sent it back to the circuit court "with instructions to set aside its decree, and to enter one providing for an ascertainment in the way courts of equity are accustomed to proceed of the damages, if any, which the complainants will suffer by the construction of the dam and appropriation of the water and for which the defendant is legally responsible; a proposition upon which we express no opinion,

and fixing a time within which the defendant will be required to pay such sum, and that upon the failure to make such payment an injunction will be issued prayed for, and on the other hand, that upon payment a decree will be entered in favor of the defendant. If the complainants shall prefer to have their damages assessed by a jury, leave may be given to dismiss the bill without prejudicing the action at law." But Mr. Justice Brewer, who wrote the opinion, expressly disclaims an intention to hold that an injunction would not have been granted on the complainants proceeding promptly. The finding of the court was that the complainants had been in treaty with the city during a long period of time, and while the city was going ahead with the work and expending large sums of money; that it was contemplated by both parties that an agreement would be come to as to the amount of money which the city should pay the complainants for the privilege of diverting the water, and that inasmuch as complainants had not brought suit for an injunction until after the position of the city had thus been greatly altered, complainants had lost their right to injunctive relief. Said the court:

> If the plaintiffs had intended to insist upon the strict legal rights (which for the purpose of this case, we assume they possessed) they should have commenced at once and before the city had gone to expense to restrain any work by it. It would be inequitable to permit them to carry on negotiations with a view to compensation until the city had gone to such great expense, and then, failing to agree upon compensation, fall back upon the alleged absolute right to prevent the work. If they had intended to rest upon such right and had commenced proceedings at once the city might have concluded to abandon the proposition undertaken and seek its water supplies in some other direction. If this injunction is permitted to stand the city must pay whatever the complainants see fit to demand, however extortionate that demand may be, or else abandon the work and lose the money it has expended. While we do not mean to intimate that the plaintiffs would make an extortionate demand we do hold the equity will not place them in a position where they can force one. * * * There is no thought of creating a new rule or of substituting a judicial opinion for an act of Congress.

And the court expressly held that the rule applied—

> * * * could never be considered as inviting a party to do a wrong with the expectation of escaping every penalty save a pecuniary one.

In the case of McCarthy et al. *v.* Bunker Hill & Sullivan Mining & Coal Co. (147 Fed. Rep. 981), affirmed 164 Fed. Rep. 927, which was a suit to enjoin the defendants from discharging débris and poisonous and polluting matter from their mines and mills into the river to the injury of the complainants, who were owners of ranches on the Cœur d'Alene River, although the district judge in his opinion said "it is not necessary to here review the testimony, but it is held insufficient to establish the alleged injury to complainant or to authorize the injunction asked," and also strongly intimated that the

complainants had not been prompt in making their complaint, thus bringing them within the rule of New York City *v.* Pine (185 N. S. 93), nevertheless the district judge mentioned, as additional ground for denying relief, the fact that the injury that would result to the defendants and to the public from the granting of an injunction would be so great as to overbalance the injury suffered by the complainants.

In the same case, upon appeal (164 Fed. Rep. 927), the Circuit Court of Appeals sustained the lower court in refusing the injunction. The opinion strongly indicates that the detriment to the defendants and to the community generally which would result from an injunction was given great weight by the court, although the opinion indicates that the court felt that there had been a failure, in large part at least, to substantiate the allegations of the bill, and, in quoting from New York *v.* Pine at some length, the court indicates that the question of laches may have had some weight.

While the case, therefore, can not be laid hold of as a definite authority for the proposition that injunctive relief will be denied because of a finding that the granting of an injunction will cause more damage to the defendants than the withholding of it will cost to the complainants, yet the language of the opinion very strongly indicates that such is the view of the court.

Perhaps the only clear-cut and definite refusal of granting an injunction upon that ground is found in the case of Salem Iron Co. *v.* Hyland (74 Ohio 160), which we have mentioned heretofore.

The Indiana Supreme Court has accepted the doctrine of the Sanderson case. In the case of Barnard *v.* Sherley (135 Ind. 547, 41 L. R. A. 737), decided September 22, 1897, the defendant in boring for gas struck mineral water which contained curative properties and installed an artificial well and built a sanitarium to utilize this water for bathing patients inflicted with all sorts of diseases. Water having been so used was caused to be drained by porous tile into a small natural stream of water which ran through the defendant's premises and through the lands of the plaintiff below. The plaintiff sued for damages and an injunction, alleging that the water thus discharged in the stream accumulated in great ponds upon her premises, becoming polluted and stagnant, causing great damage to her stock pasturing and feeding there, and endangering health of persons living on the land and drinking milk from the cows. She recovered damages to the amount of $50 and an injunction preventing the defendant from discharging into the stream water which had been used in bathing persons inflicted with infectious ailments and from polluting the water so as to render it dangerous or injurious to living stock. Upon appeal the Indiana Supreme Court quoted at length from the

case of Pennsylvania Coal Co. *v.* Sanderson (113 Pa. 126), and largely upon the authority of that case reversed the decision of the lower court. Considerable weight and importance was given to the fact that the business of the defendant was of necessity located at the particular point where the water was found.

But even in Pennsylvania and Indiana the doctrine has been strictly limited to cases where the business must be carried on at the particular point and hence the benefit of the rule is not extended to manufacturing concerns. Thus in Weston Paper Co. *v.* Pope (155 Ind. 394, 56 L. R. A. 899), decided June 22, 1900, the defendant company was discharging refuse material into Brandywine Creek to the injury of the plaintiff, through whose farm the stream flowed and the defendant sought to justify its act upon the ground that although there was injury to the plaintiff yet the importance of the business in which the defendant was engaged and the fact that it was conducting its business in a skillful manner and without negligence or malice rendered the injury damnum absque injuria.

But the Supreme Court of Indiana overruled this contention and at the same time pointed out a clear distinction between the case before it and the Sanderson case and Barnard *v.* Shirley and other Indiana cases where the injury had been excused on account of the public importance of the defendant's use of the stream. Speaking of the latter cases the court said:

> The principle underlying this class of cases is that the public has a general interest in the business carried on, as in being cured of diseases by mineral water baths, and in procuring coal for fuel, and in promoting city sanitation, and since the business is of a character that it can not be conducted at any other place than where nature has located it, or where public necessity requires it to be, individual rights must yield to the public good. The principle of these cases, however, is not applicable to the case before us. Here appellant is not engaged in the development of any natural resource, or in any usual or ordinary use of its own land. Its sole business is the manufacture of articles of commerce for its own profit. It is engaged in a business that may be carried on elsewhere less injuriously to the rights of others. It is engaged in bringing to its mill, not from its own premises, but from elsewhere, materials from which, by artificial means, it evolves putrescent matter, which it casts into Brandywine Creek, to the serious and substantial injury of lower proprietors. This appellant has no right to do. No court, so far as we have observed, has gone so far as to recognize the right of a manufacturer to establish his plant upon the banks of a nonnavigable stream and pollute its waters by a business wholly brought to the place, entirely disconnected with any use of the land itself, and which he may just as well conduct elsewhere, without responding in damages to those injured thereby, and to injunction if the injury done is substantial and continuing. (See Indianapolis Water Co. *v.* American Strawboard Co. 53 Fed. 970; Robb *v.* Carnegie Bros. 145 Pa. 324, 14 L. R. A. 329, 22 Atl. 649; Lentz *v.* Carnegie Bros. 145 Pa. 612, 23 Atl. 219; Baltimore & P. R. Co. *v.* Fifth Baptist Church, 108 U. S. 317, 27 L. ed. 739, 2 Sup. Ct. Rep. 719; Barton v. Union Cattle Co. 28 Nebr. 350, 7 L. R. A. 457, 44 N. W. 454; Mississippi Mills Co. *v.* Smith, 69 Miss. 299, 11 So. 26.

Nor did the court allow its decision to be influenced by the fact that the defendant had spent a large sum of money in its plant, etc. It was said:

* * * Before locating the plant the owners were bound to know that every riparian proprietor is entitled to have the water of the stream that washes his land come to it without obstruction, diversion, or corruption, subject only to the reasonable use of the water, by those similarly entitled, for such domestic purposes as are inseparable from and necessary for the free use of their land; and they were bound, also, to know the character of their proposed business, and to take notice of the size, course, and capacity of the stream, and to determine for themselves, and at their own peril, whether they should be able to conduct their business upon a stream of the size and character of Brandywine Creek without injury to their neighbors; and the magnitude of their investment and their freedom from malice furnish no reason why they should escape the consequences of their own folly. (Pennoyer *v.* Allen, 56 Wis. 502, 43 Am. Rep. 728, 14 N. W. 609; Tiffin *v.* McCormack 34 Ohio St. 638, 32 Am. Rep. 408; Laflin & R. Powder Co. *v.* Tearney 131 Ill. 322, 7 L. R. A. 262, 23 N. E. 389; McAndrews *v.* Collerd 42 N. J. L. 189, 36 Am. Rep. 508; Heeg *v.* Licht 80 N. Y. 579, 36 Am. Rep. 654; Baltimore & P. R. Co. *v.* Fifth Baptist Church 108 U S. 317, 27 L. ed. 739, 2 Sup. Ct. Rep. 719.)

IT HAS BEEN HELD THAT EVIDENCE OF THE CUSTOM OF THE REGION IN WHICH THE STREAM IS LOCATED MAY BE RELEVANT AS BEARING UPON THE REASONABLENESS OF A GIVEN USE.

Thus in Prentice *v.* Geiger (74 N. Y. 341) it was said:

The question whether the owner of a sawmill may lawfully discharge the sawdust therefrom into the stream would depend upon the determination of the question of fact, whether such a use of the stream was reasonable, with reference to the rights of the lower proprietors. The jury, in determining the question, would be entitled to consider all the circumstances, such as the general character and condition of the stream, its volume and rapidity, the degree of injury which is occasioned, the custom and usage of the country, and the necessity of using the stream for this purpose.

And in Red River Roller Mills *v.* Wright (30 Minn. 249), decided 1883, which was a suit by a flour-mill owner to enjoin a proprietor of a saw-and-shingle mill from discharging sawdust, bark, and other refuse into a stream, an opinion was written in which the rights of riparian owners were discussed at some length. In the course of the opinion the court said:

Evidence of the uniform and general custom in like cases is competent, although, of course, not conclusive, upon the question whether a use is a reasonable one. Usage in such matters is some proof of what is considered a reasonable and proper use of that which is a common right, because it affords evidence of the tacit consent of all parties interested to the general convenience or necessity of such use. Of course, much would depend on the character and size of the stream and the uses to which it is adapted.

So in the case of Snow *v.* Parsons (28 Vt. 459), decided 1856, which was an action brought by a sawmill owner to enjoin the

proprietor of a tannery from discharging refuse bark into the stream. The court said:

And upon the question of the reasonableness of the defendant's use of the stream, it seems to me the uniform custom of the country for generations would be of some significance in determining its reasonableness. A uniform general custom upon this subject ought, upon general principles, to have a controlling force.

And in a Michigan case, Judge Cooley said:

We think the court erred also in declining to instruct the jury on defendant's request that in determining the question of reasonable use by the defendant they might consider, among other things, the general usage of the country in similar cases. As was said in Gould *v.* Boston Duck Co. (13 Gray, 452): "Usage is some proof of what is considered a reasonable and proper use of that which is a common right, because it affords evidence of the tacit consent of all parties interested in the general convenience of such use." And see Thurber *v.* Martin (2 Gray, 394), Snow *v.* Parsons (28 Vt. 459). Indeed, in most cases this proof is the most satisfactory and conclusive that could be adduced, being established by the parties concerned, who understand better than any others what is reasonable and convenient, and who would not be likely to acquiesce in anything which was not so. (Dumont *v.* Kellogg, 29 Mich. 420.)

And the New York Court of Appeals in Strobel *v.* Kerr Salt Co. (164 N. Y. 303), decided 1900, mentions "the usage of the country" as a circumstance to be considered in determining the reasonableness of a use made of the stream. So in Salt Lake City *v.* Young (45 Utah 349, 145 Pac. 1047) the court mentioned the case of Helfrinch *v.* Catonsville Water Co. (74 Md. 269) and says of it that it "seems to sustain their contention"; that is, the contention of respondent. But the court says:

* * * That case, in my judgment is, however, not so well considered as are the cases to which I have before referred. While the Maryland case may be applicable to the conditions prevailing in that State, yet it can not be said that it can be applied to the conditions present in this State where pure water means life. * * *

BUT OTHER COURTS HAVE HELD THAT EVIDENCE OF CUSTOM CAN NOT BE RELEVANT.

For example, in an exceedingly important case, wherein it was urged that the general custom of those engaged in coal mining justified the defendant's course in allowing refuse to be placed upon the banks of a stream so that it was carried into the stream and onto plaintiff's land, the Supreme Court of Ohio disposed of that defense in the following language:

* * * Equally immaterial, as we think, is the matter of custom among coal operators in the Hocking Valley and the surrounding mining districts near thereto of depositing slack and refuse on their own lands, when such custom is invoked to justify deposits so placed as to naturally allow them to wash down to the injury of lands lying below them. The rights of the plaintiff

to the uninterrupted use of his land, and the unimpaired use of the water of Monday Creek, being secured to him by the common law, how is it possible that a custom can deprive him of them? Why should a usage, the effect of which, if recognized, is to permit one man to take from another his property rights without compensation, be sanctioned? If it be assumed that the custom is a general one, then it is a part of the common law itself; and there would be presented an instance of two rules of law, equally binding, and yet wholly inconsistent the one with the other. If it be claimed that the custom is a particular one, then we have the anomaly of a landowner's common-law right in his land taken from him by a usage of a particular trade, established by strangers, which it is not pretended he has ever been cognizant of, much less assented to. To have affected the plaintiff the custom must have been shown to be reasonable and certain, known to him, or to have been so general and well established that knowledge would be presumed, peaceably acquiesced in, and not unjust, oppressive, or in conflict with an established rule of public policy. The alleged custom possessed scarcely one of these attributes. Even though it had been common throughout the State, it would not avail. A usage which is not according to law, though universal, can not be set up to control the law. (Meyer *v.* Dresser, 16 C. B. N. S. 646; Stover *v.* Whitman, 6 Binn. 416; Inglebright *v.* Hammond, 19 Ohio, 337.) Nor could the testimony offered avail the defendant on the question of negligence. Evidence of a particular custom is sometimes admitted to explain a contract, to ascertain the intention of the parties, or to show that the mode in which a contract has been performed is the one customarily followed by others engaged in the same calling or trade; but, as a general proposition, one charged with negligence will not be allowed to show that the act complained of was customary among those engaged in a similar occupation, or those placed under like circumstances, or owing similar duties. Such an offer is, in effect, to show as an excuse for defendant's negligence, a custom of others to be equally negligent. (Deering, Neg. par. 9; Cleveland *v.* N. J. Steamboat Co. 5 Hun. 523; Judd *v.* Fargo, 107 Mass. 264; Hinckley *v.* Barnstable, 109 Mass. 126; Miller *v.* Pendleton, 8 Gray, 547; Bailey *v.* N. H. & N. Co. 107 Mass. 493; Littleton *v.* Richardson, 32 N. H. 59; Sewall's Falls Bridge Co. *v.* Fisk, 23 N. H. 171; Crocker *v.* Schureman, 7 Mo. App. 358.)

That others engaged in like business have been accustomed to disregard the rights of their neighbors can furnish no justification to the defendant to do so. (Columbus & Hocking Coal & Iron Co. *v.* Tucker, 12 L. R. A. 577, 48 Ohio St. 42, decided Jan. 13, 1891.)

The Supreme Court of New Hampshire has taken a similar view. The following language was used:

* * * The remaining question touches the admission of evidence of usage, as bearing upon the reasonableness of discharging the sawdust and shavings into the stream. There are cases where the customs and usages of trade may be proved to aid in the construction of contracts and in defining the obligations arising out of such trade. (1 Greenl. Ev. sec. 292; 2 Stark. Ev. 453, 456, and notes; Dunham *v.* Day, 13 Johns, 40; Cutter *v.* Powell, 6 T. R. 320; Noble *v.* Kenoway, Doug. 510; Dolby *v.* Hiest, 1 B. & B. 224; Renner *v.* Bank of Columbia, 9 Wheat. 581.)

But whether such customs and usages may or may not be proved to bear upon the question of reasonableness in a case not growing out of any contract, upon which we give no opinion, we are satisfied that the court erred in admitting the proof of usage in the case before us, upon the ground that the jury

may be presumed to be already sufficiently informed as to what is a reasonable use of a watercourse, as they are supposed to be as to what shall constitute a reasonable state of repair of a highway (Hubbard *v.* Concord, 35 N. H. 60; Patterson *v.* Colebrook, 29 N. H. 94), or what shall be considered a reasonable use of it by the traveler.

Our opinion therefore is that this does not belong to that class of cases concerning navigation, trade, or manufactures, about which the jury may be supposed to require the aid arising from the proof of customs or usages, but we think that admission of such evidence would be to open an extensive field of inquiry in this and similar cases, upon the same principle, that would tend greatly to increase the expenses of litigation without affording ir general any substantial aid to the jury.

The direction to the jury upon this point appears to have been based upon the highly respectable authority of Snow *v.* Parsons (28 Vt. 459), but upon a careful examination of the authorities we are unable to reconcile it with the course of our own courts upon that subject * * *. (Hays *v.* Waldron, 44 N. H. 580.)

In Honsee *v.* Hammond (39 Barb. (N. Y.) 89) the court upheld the refusal of the trial judge to charge the jury that the defendant could not be held liable for throwing tan bark into the river to the injury of the plaintiff if the discharge of the bark into the stream was done without intent to injury and in the usual way that obtains among tanneries.

IT HAS BEEN INTIMATED THAT NEW AND UNUSUAL USES WILL BE REGARDED MORE JEALOUSLY THAN COMMON AND CUSTOMARY ONES.

Courts have intimated that riparian proprietors making a new and unusual use of a stream will not be permitted the same latitude as those who are utilizing the stream for common and customary purposes. Thus, in Strobel *v.* Kerr Salt Co. (164 N. Y. 303), the court of appeals said:

When the diversion, or pollution, which is treated as a form of diversion, is caused by a new and extraordinary method of using the water, hitherto unknown in the State, and such method not only permanently diverts a large quantity of water from the stream, but also renders the rest so salt, at times, that cattle will not drink it unless forced to by necessity, fish are destroyed in great numbers, vegetation is killed and machinery rusted, such use as a matter of law is unreasonable and entitles the lower riparian owner to relief.

THE FACT THAT OTHERS THAN THE DEFENDANT OR EVEN THE PLAINTIFF HIMSELF ARE POLLUTING THE SAME STREAM WILL NOT EXCUSE THE DEFENDANT.

Woodyear *v.* Schaefer (57 Md. 1) was an action brought by the owner of a large farm on Gwynn's Falls against a defendant who owned a slaughterhouse on Gwynn's Run, a tributary of Gwynn's Falls. The suit was for an injunction against the pollution of the stream by the discharge of offal, blood, and other waste material from defendant's premises to the injury of the plaintiff.

It appeared that there were a number of other slaughterhouses discharging waste into the same stream and that in addition there were a number of breweries, soap factory, etc., and it was contended that inasmuch as the injunction against the defendant would not clear the stream but would still leave it seriously polluted, no injunction should be issued. The court said:

* * * So that the question to be decided is, Can a court of equity intervene to stop the appellee from committing the acts which constitute such an inconsiderable part of the wrong complained of, and which, if stopped, would leave the appellant still suffering from almost as great a grievance as he is now subject to? * * *

The extent to which the appellee has contributed to the nuisance may be slight and scarcely appreciable. Standing alone, it might well be that it would only, very slightly, if at all, prove a source of annoyance. And so it might be, as to each of the other numerous persons contributing to the nuisance. Each standing alone, might amount to little or nothing. But it is when all are united together, and contribute to a common result, that they become important as factors, in producing the mischief complained of. And it may only be after, from year to year, the number of contributors to the injury has greatly increased, that sufficient disturbance of the appellant's rights has been caused to justify a complaint.

One drop of poison in a person's cup may have no injurious effect. But when a dozen, or 20, or 50, each put in a drop, fatal results may follow. It would not do to say that neither was to be held responsible.

In that state of facts, as in the one presented by this case, each element of contributive injury is a part of one common whole, and to stop the mischief of the whole, each part in detail must be arrested and removed.

And in an earlier Maryland case, Gladfelter *v.* Walker (40 Md. 1), the court said:

* * * If the water of the stream was polluted by the defendant's throwing into it the drainings or refuse matter from his mill, the plaintiff was entitled to recover, unless the defendant had a prescriptive right so to foul the water.

The fact that other mill owners may have acquired such a prescriptive right was no bar to the action * * *.

In a well-considered case in New Jersey, which has been frequently cited, Vice Chancellor Pitney said:

Equally untenable is another position advanced by the defendant, viz, that the river was always more or less polluted by contributions from other mines and from the washing of plowed fields, public roads, and railroad embankments. Such insistments have been frequently made and always overruled. The question in such cases seems to be whether the stream has already become so far polluted by contributors who have acquired a right so to do by adverse use or otherwise as that the pollution presently opposed will not sensibly alter its condition. And even in such a case the courts have held that the party has the right to deal with each contributor in detail and to buy off such contributors as have acquired a right, and is not obliged to submit to fresh contributors. (Citing cases, Beach *v.* Sterling, etc.)

In Jackman *v.* Arlington Mills Co. (137 Mass. 277), it was said:

If the injury to the plaintiff resulting from the defendant's unlawful pollution of the waters of the brook can be specifically ascertained, it is no defense that the plaintiff in some degree has also polluted the brook * * *.

And in the case of Parker *v.* American Woolen Co. 195 Mass. 591, 81 N. E. 468, 10 L. R. A. (N. S.) 584, it was said:

* * * Nor is it material that other causes have contributed to the pollution of the stream. This does not excuse the defendant for its wrong doing * * *.

And in Strobel *v.* Kerr Salt Co. (164 N. Y. 303), decided 1900, the court said:

The fact that other salt manufacturers are doing the same thing as the defendant, instead of preventing relief, may require it. "Where there is a large number of persons mining on a small stream, if each should deteriorate the water a little, although the injury from the act of one might be small, the combined result of the acts of all might render the water utterly unfit for further use; and if each could successfully defend an action on the ground that his act alone did not materially affect the water, the prior appropriator might be deprived of its use, and at the same time be without a remedy." (Hill *v.* Smith, 32 Cal. 166; Woodyear *v.* Schaefer, 40 Am. Rep. 419; Sherman *v.* Fall River Iron Works Co. 87 Mass. 213; Mayor, etc. *v.* Warren Manufacturing Co. 59 Md. 96; Crossley *v.* Lightowler, L. R. (3 Eq. Cas.), 279; 2 Ch. App. Cas. 478; Pennington *v.* Brinsop Hall Coal Co., L. R. (5 Ch. Div.), 769, 772.)

In Silver Spring Bleaching & Dyeing Co. *v.* The Wanskuck Co. (13 R. I. 611), decided February 11, 1882, the court, after mentioning other defenses that were urged by the defendant, said:

* * * It also says that the complainant is itself a sinner, and pollutes the water below. That is a matter entirely between the complainant and the lower owners on the river, unless, indeed, it makes the river injurious to public health, or otherwise becomes an injury to the rights of the public, when the proper officers of the Government might interfere * * *.

In Mayor of Baltimore *v.* Warren Manufacturing Co. (59 Md. 96), decided 1882, the court, in granting an injunction, said:

* * * This source of pollution should be restrained; and even though there be other sources of pollution, or that many other persons are committing the same sort of nuisance, it forms no reason why this particular cause or source of pollution should not be restrained. (Crossley *v.* Lightowler, L. R., 3 Eq. Cas. 279; L. R. 2 Ch. App. 478).

So in Indianapolis Water Co. *v.* American Strawboard Co. (57 Fed. Rep. 1,000), decided 1893, Judge Baker said:

It is claimed that the people living along the river pollute the water by draining into it the filth and other refuse matter which accumulate on their premises. But it is no answer to a suit for creating and maintaining a nuisance that others, however many, are committing similar acts. Each one is liable to a separate suit, and may be restrained. (Wood, Nuis. par. 689; Chipman *v.* Palmer, 77 N. Y. 51.)

In Donnell *v.* Greensboro (164 N. C. 330, 80 S. E. 377) the defendant city urged in defense, among other things, that streams into which the sewage was discharged afforded the natural drainage for all that portion of the city from which sewage was discharged into them, and moreover that dyestuffs and other objectionable matter, contributing largely to the conditions complained thereof, were discharged into the stream by two mill settlements. The supreme court said:

* * * There is no objection open to defendants on their evidence that Buffalo Creek and Muddy Ford afford the natural drainage to all that portion of the city of Greensboro from which the sewage is emptied into said streams, nor by reason of the fact that there are, north of the city and outside of the corporation, two extensive mill settlements from which objectionable matter is also emptied into these streams. In the careful and comprehensive charge of the court these sources of contamination and any and all effect from them were excluded from consideration, and the jury were confined to the damages arising by reason of the operation of defendant's sewerage system and not otherwise.

And in the case of the City of Richmond *v.* Test (18 Ind. App. 482), the same position is taken as to a similar contention of the defendant city, although recovery is denied on the ground that the injury there results from the exercise by the city of a legitimate governmental function and that there can be no liability.

And to the same effect is the holding of the Supreme Court of Indiana in West Muncie Strawboard Co. *v.* Slack (164 Ind. 21), where it was said:

By the twelfth, thirteenth, and fourteenth instructions offered by the appellants it was, in effect, stated that if the streams in question were already impure and polluted before the appellants deposited their refuse matter therein, the appellee could not recover unless it was shown that the acts of the appellants rendered the waters of such streams more impure than they would otherwise have been. If so instructed, the jury might well have understood that the acts of the appellants were lawful, provided these watercourses were being contaminated by other parties also. Such is not the law. As stated in Weston Paper Co. *v.* Pope (supra), at page 402: "The fact that a watercourse is already contaminated from various causes does not entitle others to add thereto, nor preclude persons through whose land the water flows from obtaining relief by injunction against its further pollution." To the same effect see Dennis *v.* State (1883, 91 Ind. 291, 293); Strobel *v.* Kerr Salt Co. (1900, 164 N. Y. 303, 58 N. E. 142, 79 Am. St. 643, 51 L. R. A. 687).

BUT EVIDENCE THAT OTHERS THAN THE DEFENDANT HAVE CONTRIBUTED TO THE POLLUTION OF A STREAM IS ADMISSIBLE FOR THE PURPOSE OF SHOWING THAT NOT ALL THE DAMAGE SUSTAINED BY THE PLAINTIFF WAS CAUSED BY THE DEFENDANT.

It is so held in Donnell *v.* Greensboro (164 N. C. 330, 80 S. E. 377) and in Tennessee Coal, Iron & R. R. Co. *v.* Hamilton (100 Ala. 252), decided 1893.

WHERE A STREAM HAS BEEN POLLUTED FROM VARIOUS CAUSES FOR LONGER THAN A PRESCRIPTIVE PERIOD TO SUCH AN EXTENT THAT IT HAS BECOME A COMMON SEWER, THE RIGHT TO POLLUTE IT CAN NOT BE CHALLENGED.

In the case of the City of Cleveland *v.* Standard Bag, etc., Co. (72 Ohio St. 324, 3 A. & E. Ann. Cas.), decided in 1905, plaintiff was a proprietor of a paper works in the city of Cleveland on both sides of Kingsbury Run and sued the city for an injunction and damages for polluting that stream by the discharge of sewage from the city by means of sewers constructed in the years 1896, 1898, and 1899.

Before the trial of the case the plaintiff sold its premises, and hence was held not entitled to injunctive relief. The court of common pleas awarded damages, however, and upon appeal to the circuit court damages were also awarded. The city appealed to the supreme court, and it was there held that the plaintiff, having lost its right to equitable relief through the sale of its property, the only right of action that survived was the claim for damages, in the trial of which the city would have been entitled to a jury.

But the court further discussed the case upon its merits, and held that the plaintiff was not entitled to relief upon the merits.

It appeared that for upward of 21 years the stream had been so polluted that the plaintiff had not been able to utilize it for the purposes of its plant. That the inhabitants of the valley generally contributed to the polluted condition and that a number of large establishments discharged all sorts of sewage and refuse into the stream. These establishments included a slaughterhouse, numerous oil refineries, a paint factory, ice works, candle and axle grease works, lubricating-oil works, and soap works. It was also found that the plaintiff itself discharged sewage into the stream. There appears to have been no finding that the pollution amounted to a public nuisance. The supreme court said:

* * * It appears that for very many years the owners of property lying by Kingsbury Run for more than a mile above the company's premises have generally treated it as completely diverted from the primary uses of a flowing stream to those of a public open sewer. It is sufficient for present purposes that both the company and the city, the parties who will be concluded by the judgment in the present case, have so treated it continuously and uninterruptedly for more than 21 years prior to the bringing of this suit. To that diversion both parties have effectively contributed.

And the court held that an easement had been acquired by prescription which authorized this city to utilize the run for sewage purposes. The court further says:

* * * That during the period named the city has increased the amount of sewage discharged into the run is unimportant. For more than 21 years before the beginning of this action pollution from sewers of the city, the

works of the company, and the multitudinous other sources mentioned in the statement of the case has rendered the water wholly and admittedly unfit for any form of domestic use and devoted the run to sewerage purposes. The added sewers required by the growth of the city have been but a natural increase by it in the use of what was already a public sewer.

And the court further points out as its conclusion that Kingsbury Run is not to be regarded as a stream which is under the protection of the rules of law against pollution and—

may exempt the company from the ruinous consequences of indictment and punishment under section 6919 and the following sections of the Revised Statutes providing for the punishment of offenses against public health. * * *

And in Parker *v.* American Woolen Co. (195 Mass. 591, 81 N. E. 468, 10 L. R. A. (N. S.) 584), while granting an injunction against the defendant company, and holding that it was not "material that other causes have contributed to the pollution of the stream," yet said:

Nor is this a case in which the defendant is simply discharging noxious matter into an already polluted stream. It is expressly found by the master that the water when it reaches the defendant's premises "is good, clean, clear brook water, fit for any kind of manufacture or for domestic use."

And again in MacNamara *v.* Taft (196 Mass. 597, 83 N. E. 310, 13 L. R. A. (N. S.), 1044), decided January 1, 1908, the court, after citing the American Woolen Co.'s case, said:

* * * In that case, as in the present, the stream under consideration was substantially unpolluted by manufacturing or other impurities, and was nearly in its natural state, except for the acts of the defendant, and was not used under the authority of law for the discharge of sewage or other noxious substances, as some streams are which have been taken and appropriated to such a public use.

WHEN A STREAM IS POLLUTED BY AN UPPER RIPARIAN OWNER IN AN UNREASONABLE WAY OR TO AN UNREASONABLE EXTENT, ANY LOWER RIPARIAN PROPRIETOR WHO IS INJURED THEREBY, HAS A RIGHT OF ACTION AT COMMON LAW FOR THE ACTUAL DAMAGES SUSTAINED BY HIM.

In Columbus & Hocking Coal & Iron Co. *v.* Tucker (12 L. R. A. 577,48 Ohio St. 42), it was said:

* * * Attention is also called to Shearman & Redfield on Negligence, paragraphs 733, 734. "It is a general principle that any person who, without authority, diverts the whole or part of the water of a stream from its natural course, or interferes with its natural current, is responsible absolutely, and without any question of negligence, to anyone who is entitled to have the water flow in its natural state. Any use of the land near a stream, or of the water of a stream itself, which renders the water unwholesome, offensive, or unfit for the purposes for which it is used, is unlawful; and any riparian owner who is damaged by such unlawful acts has an action for his damages against the author of the wrong."

The cases sustaining this holding are almost innumerable, but among them the following may be noticed:

H. B. Bowling Coal Co. *v.* Ruffner, 117 Tenn. 180, 100 S. W. 116; 9 L. R. A. (N. S.) 923; 10 Ann. Cas. 581, decided February 19, 1907.

Chapman *v.* City of Rochester, 110 N. Y. 273.

Clifton Iron Co. *v.* Dye, 87 Ala. 468.

Drake *v.* Lady Ensley Coal Co. 102 Ala. 501; 24 L. R. A. 64.

Elder *v.* Lykens Valley Coal Co. 157 Pa. 490.

Good *v.* Altoona, 162 Pa. 493.

Honsee *v.* Hammond, 39 Barb. 89.

Penn. Am. Plate Glass Co. *v.* Schwinn, 177 Ind. 645; 98 N. E. 715, decided May 28, 1912.

Straight *v.* Hover, 79 Ohio St. 263, decided January 26, 1909.

Stockport Waterworks Co. *v.* Potter, et al. 7 Exch. 159, decided 1861.

Thomas *v.* Brockney, 17 Barb. 654, decided 1851.

Tennessee Coal, Iron & R. R. Co. *v.* Hamilton, 100 Ala. 252, decided 1893.

Tetherington *v.* Donk Bros. Coal & Coke Co. 232 Ill. 522, decided February 20, 1908.

Weston Paper Co. *v.* Pope, 155 Ind. 394, 56 L. R. A. 899, decided June 22, 1900.

Winchell *v.* Waukesha, 110 Wis. 101, 85 N. W. 668.

Such a right of action is upheld by the overwhelming weight of authority and appears to have never been denied except under the peculiar circumstances obtaining in cases like the Sanderson case, where the right of the lower owner is made to yield to the rights of an upper proprietor who is developing important natural resources, and, even under those circumstances, only in the States of Pennsylvania and Indiana.

IT IS IMPROPER IN AN ACTION FOR DAMAGES FOR SEVERAL RIPARIAN PROPRIETORS TO JOIN AS PLAINTIFFS. EACH SHOULD SUE SEPARATELY FOR THE DAMAGES HE HAS SUSTAINED.

In Foreman et al. *v.* Boyle et al. (88 Cal. 290, 26 Pac. 94) plaintiffs sued the defendants for damages sustained by them because of the defendants having diverted the water of Canon Creek and the west branch of Canon Creek to natural water courses, upon one of which the plaintiff Foreman owned a tract of land, and upon the other of which the plaintiff Rogers owned a tract. The defendants demurred to the complaint on the grounds that there was a misjoinder of parties plaintiff. This demurrer was overruled, but upon appeal the Supreme Court said:

It will be observed that the plaintiff Foreman owns a tract of land, 15 inches of water, and the ditch which carries the water from West Canon Creek upon her land. Her coplaintiff, Rogers, has no interest whatever in the land, the water, or the ditch. Likewise, plaintiff Rogers owns a tract of land (some distance from Foreman's land), 85 inches of water, and the ditch which carries

the water from Canon Creek upon his land; and his coplaintiff has no interest in such land, water, or ditch.

These plaintiffs claimed in their complaint, and obtained by decree of the court, a joint judgment for damages against the defendants.

It is impossible to see how the plaintiffs have any joint or common interest in the damages recovered or upon what legal basis such damages could be apportioned between them. Respondents' counsel suggest that the plaintiffs are tenants in common, and the damages should be apportioned in proportion to the number of inches of water each owns. This can not be the true rule for it readily can be seen that for many reasons the diversion of the waters by defendants may have caused plaintiff owning 15 inches of water far greater damage than would have been entailed upon plaintiff owning 35 inches of water * * *.

Two or more owners of mills, propelled by water, are interested in preventing an obstruction above that shall interfere with the downflow of the water, and may unite in its restraint or abate it as a nuisance, but they can not hence unite in an action for damages for, as to the injury suffered, there is no community of interest. (Bliss on Code Pleading, sec. 76.)

And in the case of Geurkink *v.* city of Petaluma (112 Cal. 310, 44 Pac. 570) the defendant city was sued for damages and for an injunction, the basis of the action being that it had changed the natural channel of the stream to the injury of both the plaintiffs. The Supreme Court said:

* * * As to the relief sought by injunction the plaintiffs were properly joined, but as to damages there was a misjoiner. If damages are sought for the acts of defendants the plaintiffs must sue separately. (Foreman *v.* Boyle, 88 Cal. 290.)

And to the same effect is the holding of the same court in Senior *v.* Anderson (138 Cal. 723, 72 Pac. 319).

IT HAS BEEN HELD TO BE IMPROPER TO JOIN SEVERAL DEFENDANTS IN AN ACTION FOR DAMAGES ARISING FROM THE POLLUTION OF A STREAM TO WHICH THE VARIOUS DEFENDANTS HAVE CONTRIBUTED INDEPENDENTLY.

In Witland *v.* Red Bank Oil Co. (151 Ill. App. 433) it was said:

A person polluting a watercourse is liable in damages only for his own act, and not for that of any others who may contribute to the injury. If others have contributed, his deposit must be separated by means of the best proof the nature of the case affords, and his liability ascertained accordingly. (2 Farnham, Waters, 1716; Serley *v.* Alden, 61 Pa. 302, 100 Am. Dec. 642; Chipman *v.* Palmer, 77 N. Y. 51, 33 Am. Rep. 566.) We are of opinion that the acts of each of the defendants in allowing the escape of oil upon its own premises was separate and independent, and without any connection with the acts of the others, and being a several act when committed, it can not be made joint because of the consequences which followed in connection with others who had done similar acts, and while it is true it is difficult or impracticable to separate the injury, that is no reason why one of the defendants should be liable as a joint tort-feasor (among whom there is no contribution), because of the consequence which followed the acts of others who have not acted in concert with it.

And in Bowman v. Humphrey (132 Iowa 234), at page 240, it was said:

* * * Joint liability of wrongdoers, each for all and all for each, exists only where the wrong itself is joint. If the separate wrongful acts of two or more persons, acting independently without concert, plan, or agreement, unite to cause injury to another, such persons are not joint wrongdoers within the meaning of the law, and each is liable to the injured party for only so much of said injury as is chargeable to his own separate individual act. (Bonte v. Postel, 109 Ky. 64, 58 S. W. 536, 51 L. R. A. 187; Sparkman v. Swift, 81 Ala. 231, 8 South. 160; Bard v. Yohn, 26 Pa. 482; La France v. Krayer, 42 Iowa, 243; Harley v. Merrill, 83 Ohio, 79; De Donato v. Morrison, 160 Mo. 581, 61 S. W. 641; Little Schuylkill Navigation R. & Coal Co. v. Richards, 57 Pa. 142, 98 Am. Dec. 209; Wiest v. Electric Traction Co. 200 Pa. 148, 49 Atl. 981, 58 L. R. A. 666; Lull v. Improvement Co. 19 Wis. 101.) As suggested by the Pennsylvania court, if the tort of the parties was several when committed it did not become joint because of the union of the consequences of the several torts in producing an injury. (Wiest v. Electric Traction Co., supra; Gallagher v. Kemmerer, 144 Pa. 509, 22 Atl. 970, 27 Am. St. Rep. 673.)

THERE ARE SOME DECISIONS TO THE CONTRARY, THE REASONING BEING THAT IT IS IMPOSSIBLE TO SEPARATE THE INJURY DONE BY THE SEVERAL CONTRIBUTORS AND THAT TO DENY THEIR JOINT LIABILITY IS TO LEAVE THE LOWER PROPRIETOR WITHOUT REMEDY FOR THE INJURY HE HAS SUSTAINED.

And so it has been held that where several independently contribute to the pollution of the stream and where the damage caused by each is not ascertainable, each is liable for all the damage caused.

In Day v. Louisville Coal & Coke Co. (60 W. Va. 27, 53 S. E. 776, 10 L. R. A. (N. S.) 167), where the defendant was sued for damages for having injured the plaintiff, a lower riparian proprietor, through the deposit of slag, cinders, tailings, etc., from the defendant's mine in the stream, the defendant urged that other mines were depositing similar substances in the stream and that the defendant could not be held liable for any damage except such as could be proven to have been caused by its acts. The supreme court said, regarding this contention:

There are some authorities to support this proposition, but the authorities against it very decidedly preponderate, and they harmonize with right, reason, and the established law of centuries. This damage comes from tort, not contract; and it is a rule of law as old as the hills that in a tort all participating or contributing in the wrong working the injury, are liable, and any single one is liable. One can be sued, or more can be sued. It is contended for the defendant that the acts of these different operators were independent of each other, the defendant's act separate and distinct from the other; and that it is only where tort-feasors act jointly that one or all may be sued. This proposition can not be sustained, as will appear from the following authorities (citing cases).

In Indiana it is held that, while generally speaking, it is wrong to join, as defendants in an action for damages, those whose inde-

pendent acts have contributed to the plaintiff's injury without cooperation on the part of the defendants, yet that where the acts which produced the damage not only injure the plaintiff, but create a public nuisance, the defendants may be joined.

In the case of West Muncie Strawboard Co. *v.* Slack (164 Ind. 21) the plaintiffs were tenants in common of farming land on White River, and sued the West Muncie Strawboard Co. and Muncie Pulp Co. and other defendants who were the proprietors of similar mills discharging chemicals and other deleterious substances into Buck Creek and White River, so that they intermingled in the waters of White River above plaintiff's land and rendered the water unfit for stock purposes, caused the deposits of sediment upon the plaintiff's premises, killed vegetation, and damaged the soil.

The Supreme Court of Indiana said:

Objection is made by the appellants that the acts alleged, if done at all, were performed severally and independently by them, and hence there can be no joint liability therefor. It is probably true that an action at law for the recovery of money damages, as distinguished from a suit in equity, can not be maintained jointly against various tort-feasors among whom there is no concert or unity of action and no common design, but whose independent acts united in their consequences to produce the damage in question. (Miller *v.* Hughland Ditch Co., 1891, 87 Cal. 430, 25 Pac. 550, 22 Am. St. 254; Lockwood Co. *v.* Lawrence, 1885, 77 Me. 297, 52 Am. Rep. 763; Sloggy *v.* Dilworth, 1888, 38 Minn. 179, 36 N. W. 451, 8 Am. St. 656; Martinowsky *v.* City of Hannibal, 1889, 35 Mo. App. 70; Chipman *v.* Palmer, 1879, 77 N. Y. 51, 33 Am. Rep. 566; Blaisdell *v.* Stephens, 1879, 14 Nev. 17, 33 Am. Rep. 523; Long *v.* Swindell, 1877, 77 N. C. 176; Little Schuylkill Nav. etc. Co. *v.* Richards, 1868, 57 Pa. St. 142, 98 Am. Dec. 209; Draper *v.* Brown (1902), 115 Wis. 361, 91 N. W. 1001; The Debris Case (1883), 15 Fed. 25. And see Sellick *v.* Hall (1879), 47 Conn. 260).

A distinction, however, is recognized between such acts which are wrongful only because injurious to individual rights, and those which combine and constitute a public nuisance. (Simmons *v.* Everson, 1891, 124 N. Y. 319, 26 N. E. 911, 21 Am. St. 676; Irvine *v.* Wood, 1872, 51 N. Y. 224, 10 Am. Rep. 603; City of Valparaiso *v.* Moffitt, 1895, 12 Ind. App. 250, 255, 54 Am. St. 522.)

In the former class of cases each separate wrongdoer is chargeable with his own acts alone, in the absence of a joint purpose among the participants; in the latter, each may be answerable in a joint and several action not only for what he himself does, but likewise for the acts of those who, with him, violate public as well as private rights. If a party deliberately places himself in opposition to the entire community by performing an act which, in combination with the independent wrongful acts of others, violates an express statute and creates a public nuisance, he is not in a position to assert that he should be held responsible to individuals specially damaged for only the actual loss he alone has occasioned them. He must have anticipated the natural and probable consequences of his acts, namely, the violation of a public right; and the public interest requires he shall, if need be, even in a civil action, bear the full burden of the wrong he has assisted in inflicting. Nor is it material that his act of itself, and without reference to the cooperation of others, would create a public nuisance. He must be deemed to know, in a case such as the present, that, if his wrong combines with similar acts of

third parties, the result will be to intensify the public and private injury. The welfare of the community demands that he who thus intentionally and aggressively assists either in creating or maintaining a public nuisance in defiance of positive enactments shall answer in civil damages for all injurious consequences proximately resulting therefrom to private individuals who bring themselves within the requirements of the law.

There can be no question but that the acts of the appellants constituted a public nuisance (sec. 2154 Burns, 1901; sec. 2066 R. S., 1881; City of Valparaiso *v.* Moffitt, supra), and hence they could be held jointly and severally liable at the suit of parties specially damaged.

The case of West Muncie Strawboard Co. *v.* Slack, does not appear to have been followed upon the proposition that when the pollution of a stream amounts to public nuisance, those creating the nuisance are jointly liable.

In an exhaustive opinion the Ohio Supreme Court in the City of Mansfield *v.* Briston (76 Ohio St. 270, 81 N. E. 631, 118 Am. St. Rep. 852), decided January, 1907, reviewed at very great length the authorities holding that there is no joint liability among those who pollute a stream independently and then said:

The cases have been noticed at such great length because in the recent case of West Munice Strawboard Co. *v.* Slack (164 Ind. 21, 72 N. E. 879), it is said: "A distinction, however, is recognized between such acts which are wrongful only because injurious to individual rights and those which combine and constitute a public nuisance." And it was there ruled that "one who creates a public nuisance is responsible to individuals especially damaged, not only for the actual loss he alone has occasioned them, but also for the damages caused by similar acts of third persons which independently occur in causing the injury complained of."

The Ohio Supreme Court, after quoting further from the Indiana case, analyzes the authorities cited by the Indiana court to sustain its position, and then says:

* * * It will be observed that in none of these cases is the fact that the act was a public nuisance, as distinguished from a private nuisance, given as a ground of joint liability. Indeed, Slater *v.* Mersereau (225, 64 N. Y. 138) is a case not of public but of private nuisance.

The distinction suggested in West Muncie Strawboard Co. *v.* Slack (164 Ind. 21, 72 N. E. 879) has no foundation in precedent, and is not believed to be maintainable on principle. The distinction assumes that several torts have been committed, but holds the perpetrator of one liable for the damage from all on the sole ground that his act is a public wrong. If I give you a beating to-day, or rather, if you to-day beat me and to-morrow another does likewise, and in consequence I take to bed, are you liable to me in damages for all of my injuries because your act was unlawful?

Both logic and the great weight of authority would seem to be upon the side of the denial of joint liability in the absence of joint action. It is obvious, on one hand, that very great injustice might be done to an upper proprietor, who had contributed somewhat to the pollution of the stream, by holding him liable for all of the in-

juries sustained by some lower proprietor; in other words, he might be held liable, in an amount out of all proportion to the damage caused by himself, and such would be the necessary result of recognizing joint liability at all, because there is no contribution among joint tort-feasors. On the other hand, to deny joint liability in an action for damages does not deprive the lower proprietor of his universally recognized right to bring a single action for injunction against all contributors, and if such action be brought promptly, it would seem that in most cases the mischief could be stopped before any great damage had accrued.

Moreover, the difficulty of separating the damage done by one upper proprietor from that done by another might not be of as great practical importance as would at first appear. In any action for damages, the plaintiff would have to show, first, that he had been substantially injured, and, secondly, that the action of the defendant had produced that injury. Would it be too great a burden to require the plaintiff to go further and show the proportion of the aggregate damage caused by the particular defendant?

SO WHERE THE CAUSE OF INJURY TO A STREAM HAS BEEN MAINTAINED BY SUCCEEDING PROPRIETORS, THE LOWER PROPRIETOR WILL NOT BE PERMITTED TO JOIN THEM IN AN ACTION FOR DAMAGES BUT MUST SUE EACH SEPARATELY.

Greene *v.* Nunemacher, 36 Wis. 50.

AN UNREASONABLE USE OF A STREAM WHICH POLLUTES IT TO THE INJURY OF A LOWER RIPARIAN PROPRIETOR WILL BE ENJOINED.

In Holsman *v.* Boiling Spring Bleaching Co. (14 N. J. Eq. 335), decided 1862, it was said:

* * * It is a familiar exercise of the power of the court to prevent by injunction injury to watercourses by obstruction or diversion. (Fich. *v.* Resbridger, 2 Vern. 390; Bush *v.* Western, Prec. in Chan. 530; Gardner *v.* Village of Newburgh, 2 Johns, Ch. R. 165; Shields *v.* Arndt, 3 Green's Ch. R. 234.)

The right of the riparian proprietor, says Chancellor Kent, to the use and enjoyment of a stream of water in its natural state is as sacred as the right to the soil itself. It is a part of the freehold of which no man can be disseized but by lawful judgment of his peers or by due process of law. (2 Johns. Ch. R. 166.)

A disturbance or deprivation of that right is an irreparable injury for which an injunction will issue.

If the deprivation of the use of the water by diversion constitutes such an irreparable injury as will be restrained by injunction, the deprivation of its use, by so corrupting it as to render it unfit for use, is an equally irreparable injury entitling the party injured to the like preventive remedy.

In Davis *v.* Lambertson (56 Barb. 480), it was said:

* * * The law does not allow one to appropriate or injure the property of another permanently, offensively, and annoyingly, and compel the plaintiff to seek redress in successive suits at law; especially where it is so difficult, as in this case, to give any exact proof of the actual damages.

It does not allow the property of one man to be taken for the use of any other person or association, except in the cases prescribed in the Constitution, either with or without compensation, and I can see no difference between the allowing the taking of it against his consent or allowing another to use his own property in such a manner as to pollute it, and seriously impair its value and use. In short, exact justice can only be done by the courts, in such cases, where they restore the injured party, so far as they can, to the rights of which he has been deprived.

In Beach *v.* Sterling Iron & Zinc Co. (9 Dick., N. J. 65) the following language is used:

The result of my consideration of the subject is that there is no principle which will sustain a court of equity in refusing an injunction against the maintenance of an established continuing nuisance and leaving the injured party to his remedy at law. To do so is, in effect, to permit a party to take his neighbor's land for his own use upon terms of making such compensation as a jury shall assess. This is inadmissible.

In Indianapolis Water Co. *v.* American Strawboard Co. (53 Fed. Rep. 970), decided 1893, Judge Baker says:

* * * The depositing of any substances in the stream which corrupt or pollute the water to such a degree as essentially to impair its purity, and prevent its use for any reasonable and proper purpose to which running water is usually applied, is an infringement of the right of other owners of land through which the stream flows. An action for damages may be maintained by a riparian proprietor for the pollution of a stream. So a perpetual injunction will be granted to restrain such pollution, especially if it is of a continuous nature, even when the plaintiff could only recover nominal damages at law, because of the inconvenience of repeated actions, and the danger of the acquisition of an adverse right to pollute it by its continuance for 20 years. So, also, a perpetual injunction will be granted to restrain the pollution of a stream where the nature of the injury is such as to render it difficult or impracticable to adequately measure the damages, and fully compensate for the wrong. (Gould, Waters (2d ed.), par. 223, and cases cited in note 1; Merrifield *v.* Lombard, 13 Allen 16; Lyon *v.* McLaughlin, 32 Vt. 423; Holsman *v.* Spring Bleaching Co. 14 N. J. Eq. 335; High Inj. (3 ed.), pars. 749–795.)

Other important cases in which an injunction has been granted in suits between private riparian proprietors are:

Lockwood Co. *v.* Lawrence, 77 Me. 297, decided Apr. 22, 1885.
Carhart *v.* Auburn Gas Light Co., 22 Barb. 297.
Middlestadt *v.* Waupaca Starch & Potato Co., 93 Wis. 1.
Parker *v.* American Woolen Co., 195 Mass. 591; 81 N. E. 468; 10 L. R. A. (N. S.) 584.
Richmond Manufacturing Co. *v.* Atlantic De Laine Co., 10 R. I. 106.
Sandusky Portland Cement Co. *v.* Dixon Pure Ice Co. 221 Fed. 200; L. R. A. 1915 E. 1210; decided Jan. 15, 1915.
Silver Spring Bleaching & Dyeing Co. *v.* The Wanskuck Co., 13 R. I. 611, decided Feb. 11, 1882.
Strobel *v.* Kerr Salt Co., 164 N. Y. 303, decided 1900,

wherein it was said:

* * * Where the natural and necessary result of the place selected, and the method adopted by an upper riparian owner in the conduct of his business is to cause material injury to the property of an owner below, a court of equity

will exercise its power to restrain on account of the inadequacy of the remedy at law and in order to prevent a multiplicity of suits.

Western Paper Co. *v.* Pope, 155 Ind. 394; 56 L. R. A. 899; decided June 22, 1900.

Worthen & Aldrich *v.* White Spring Paper Co., 74 N. J. Eq. 647, decided June 10, 1908.

where the contention of the defendant that the remedy of the plaintiff was an action at law for damages only and not by injunction, was thus summarily disposed of:

The claim made by the defendant that the complainant's remedy for the injury is by common-law action for damages is effectually disposed of by the Beach case.

Woodyear *v.* Schaefer, 57 Dd. 1.

Barton *v.* Union Cattle Co., 28 Nebr. 850; 44 N. W. 454, 7 L. R. A. 457.

Canfield *v.* Andrew, 54 Vt. 1, decided 1882.

MacNamara *v.* Taft, 196 Mass. 597; 83 N. E. 310; 13 L. R. A. (N. S.) 1044; decided Jan. 1, 1908.

Baxendale *v.* McMurray, L. R. 2 Ch. 790 (1867).

Red River Roller Mills *v.* Wright, 30 Minn. 249, decided 1883.

SEVERAL WHO CONTRIBUTE INDIVIDUALLY TO THE POLLUTION OF THE SAME STREAM MAY BE JOINED AS DEFENDANTS IN ONE SUIT FOR AN INJUNCTION.

Thus in Lockwood Co. *v.* Lawrence (77 Me. 297), decided April 22, 1885, the defendants were a number of proprietors of mills on the Kennebec River. From the different mills there was discharged sawdust, edgings, shavings, refuse wood, and other débris, which became commingled into one indistinguishable mass and flowed into the ponds, raceways, etc., of the complainants, lower proprietors on the stream, and injured their wheels and retarded their manufacturing operations, they being the proprietors of a cotton mill.

The defendants insisted that, as their acts were individual and separate, they could not be joined as defendants in one action. The court held, however, that although the acts of the different defendants may have been individual and separate, yet—

There is cooperation in fact in the production of the nuisance "and held that in equity it was" proper to join defendants individually contributing to the pollution of the same stream, although in an action of law for damages the rule would be different.

And cited as sustaining this holding the following cases:

Woodruff v. Northbloomfield Gravel Mining Co., 8 Sawyer (U. S. C. C.) 628;

Hillman *v.* Newington, 57 Cal. 56;

Blaisdell *v.* Stephens, 14 Nev. 17;

Pomeroy's Equitable Jurisdiction, pars. 269, 1394;

Chipman *v.* Palmer, 77 N. Y. 56;

Duke of Buccleugh *v.* Coman, 5 Macph. 214;

Crossley *v.* Lightowler, 3 L. R. Eq. 279;

Thorpe *v.* Brumfitt, 8 L. R. Ch. App. 650.

In Warren *v.* Parkhurst (45 N. Y. 466; 78 N. E. 579; 6 L. R. A. (N. S.) 1149) plaintiff filed a bill against a number of defendants, charging that they were all polluting a stream upon which plaintiff was lower proprietor and that—

> the damages suffered by the plaintiff from the pollution of the stream by any one defendant, if there were no other sources of pollution, would be nominal; but from the concurring and continuous trespass of all the defendants, the injury which the plaintiff and his lands sustain is great, and, if the said nuisance is continued, will be irreparable, and the said lands and tenements will be rendered wholly worthless for domestic or other purposes.

The New York court of appeals upheld the right of the plaintiff to sue these defendants jointly in one action, relying very largely on the authority of Lockwood Co. *v.* Lawrence (supra).

SEVERAL INDIVIDUALS WHO ARE INJURED BY THE POLLUTION OF THE SAME STREAM MAY JOIN IN AN ACTION FOR AN INJUNCTION.

In Middleton *v.* Flat River Booming Co., Judge Cooley said:

> This was a bill in equity by a number of owners of mills and factories on Flat River, to enjoin the defendants from various acts which it is alleged tend to render the water power by which their machinery is operated of little value to them. The bill was demurred to on various grounds and was dismissed in the court below.
>
> One objection is that the parties complainant have no common interest. They are owners of several mills, and only have a common interest in the question involved. The case is within the decision in Scofield *v.* Lansing (17 Mich. 437). No accounting is asked for by complainants, and so far as the bill discloses the facts, the question is single, and no embarrassment can be occasioned by this joinder of complainants.

And in Strobel *v.* Kerr Salt Co. (164 N. Y. 303), decided 1900, where 14 plaintiffs owning various mills on the Oatka Creek, joined in a suit for an injunction against the defendant corporation, engaged in the manufacture of salt above all of the mills of the different plaintiffs, to prevent the defendant from continuing to divert and pollute the water of the stream, the defendant insisted that the plaintiffs were improperly joined, but the New York court of appeals said:

> The objection that the plaintiffs have no cause of action common to all, and hence that they can not sue jointly, is unsound. While each owns a distinct piece of land situated upon a part of the stream separate from that abutted upon by the land of every other owner, they all have a common grievance against the defendant for an injury of the same kind, inflicted at the same time and by the same acts. The common injury, although differing in degree as to each owner, makes a common interest and warrants a common remedy. (Emery *v.* Erskine, 66 Barb. 9, 14; Reid *v.* Gifford, Hopkins' Ch. 416, 477; Murray *v.* Hay, 1 Barb. Ch. 59, 62; Blunt *v.* Hay, 4 Sand. Ch. 362.

TO ENTITLE A RIPARIAN OWNER TO AN INJUNCTION AGAINST POLLUTING A STREAM, THE INJURY OF WHICH HE COMPLAINS MUST BE REAL AND MATERIAL.

Boyd *v.* Schreiner, 116 S. W. 100; decided Jan. 27, 1909.
Indianapolis Water Co. *v.* American Strawboard Co., 57 Fed. Rep., 1000, decided 1893,

wherein it was said:

* * * courts will not interpose by injunction to prevent a mere eventual or contingent nuisance, nor will they interpose when the injury is remote or contingent, and rests merely in speculation. A very strong case must be made by the bill to justify the court in granting injunctive relief; and, if there is reasonable doubt of the effect of the alleged nuisance on the construction of the facts alleged in the bill, there will be no interference until the matter is tested by actual experience.

MacNamara *v.* Taft, 196 Mass. 597; 83 N. E. 310; 13 L. R. A. (N. S.) 1044; decided Jan. 1, 1908.
Snow *v.* Parsons, 28 Vt. 459.
Hayes *v.* Waldron, 44 N. H. 580.
Red River Roller Mills *v.* Wright, 30 Minn. 249.

BUT ALTHOUGH THE INJURY TO THE STREAM MUST BE REAL IN ORDER TO ENTITLE THE PLAINTIFF TO INJUNCTIVE RELIEF, IT DOES NOT FOLLOW THAT THE PLAINTIFF MUST HAVE SUFFERED ANY ACTUAL DAMAGE IN HIS PRESENT USE OF THE STREAM.

In New York Rubber Co. *v.* Rothery (132 N. Y. 293) the action was for damages arising from diversion of water and not pollution, but the reason upon which the decision rests is equally applicable to pollution cases. In that case the court charged the jury that the question involved was—

Have the Rotherys, by this watercourse, diverted the water so as to leave the stream to a material and appreciable extent insufficient for the purposes of plaintiff's business? Now, gentlemen, that is all there is of the case.

The plaintiff had requested the court to charge—

that the plaintiff's right to maintain this action and to recover a verdict for nominal damages does not depend at all upon the plaintiff's showing any actual or any perceptible damage, but solely upon the question whether the defendants have, by the use of their race, at any season of the year diverted water from Matteawan Creek, and thereby have reduced perceptibly and materially the volume or current of water which otherwise would have flowed by the plaintiff's premises.

and this request has been refused. The court of appeals said:

Both the charge and refusal were erroneous.

The plaintiff's right to recover nominal damages was substantial, though the quantity of damages was not. The defendants probably did leave water

enough in the stream for the purposes of the plaintiff's business, as that business had been conducted. But the plaintiff's title to its water rights, and its right to redress for their invasion were not conditional upon the beneficial user of them. (Corning *v.* Troy Iron & Nail Factory, 40 N. Y. 191; Crooker *v.* Bragg, 10 Wend. 260, 25 Am. Dec. 555; Webb. *v.* Portland Mfg. Co. 3 Summer, 189; Parker *v.* Griswold, 17 Conn. 288, 42 Am. Dec. 739; Clark *v.* Penn. R. R. Co., 22 Atlantic Rep. 989.)

The plaintiff may, however, lose its title by the defendants' prolonged adverse user of the water of the stream, and this is the more probable if such adverse user is protected by the verdict of the jury. It is not improbable that this action was brought to prevent the defendants from acquiring a prescriptive right to divert the water. * * *

In such a case nominal damages given confirm the plaintiff's right, but withheld, impeach, and may destroy it. (Hammon *v.* Zehner, 21 N. Y. 118.)

The request to charge presented the plaintiff's rights clearly. (Garwood *v.* New York Cent. etc., R. Co., 116 N. Y. 649.)

In Gladfelter *v.* Walker (40 Md. 1) it was said:

* * * The plaintiff sues for an invasion of his rights by the defendant, and if such rights have been invaded, an action will lie, although he may not have suffered any actual damage.

Otherwise the defendant, by continuing the practice for 20 years, might establish as against the plaintiff, the right to discharge into the stream the foul water from his mill. (Wood *v.* Waud, 3 Exch. 772; Embrey *v.* Owen, 6 Exch. 353; Johns *v.* Stevens, 3 Vt. 308; Thomas *v.* Brackney, 17 Barb. 654; Ripka *v.* Sergeant, 7 Watts & Ser., 9.)

And in Parker *v.* American Woolen Co. (195 Mass. 591; 81 N. E. (N. S.) 468; 10 L. R. A. 584) the Supreme Court of Massachusetts said:

* * * Nor can we doubt that the plaintiff is entitled to an injunction to restrain the defendant from continuing to pollute the stream, in order to prevent it from gaining a prescriptive right, even though such pollution does not interfere with any use of the water which the plaintiff is now making.

An opposite view was taken by the Supreme Court of Maine in the case of Lockwood Co. *v.* Lawrence (77 Me. 297), decided April 22, 1885. In that case the defendants contended that they had acquired a prescriptive right to discharge the waste matter complained of into the Kennebec River, having so utilized the river for more than the statutory period. It appears to have been conceded by the court that the defendants had so used the stream for the requisite period, but the court took the position that such use was not in the early part of the period adverse, because at that time the lower riparian proprietors were using the stream for such purposes as sawmills, tanneries, etc., and that the use made by the defendants only became adverse at a later time when the plaintiff installed its cotton mills.

The reasoning of the court is based on the proposition that—

* * * It is well settled that in order to establish the presumption of a right or easement in the land or waters of another person, the enjoyment of such right must have been uninterrupted, adverse, under claim of right, and with the knowledge of the owner, or with such acts that knowledge will be presumed (citing cases). And it must have been inconsistent with or contrary to the interest of the owner, and of such a nature that it is difficult or impossible to account for it, except on the presumption of a grant from him, otherwise no such presumption arises (citing cases). The prescriptive right to the use of a stream beyond the general right of reasonable use, as against other riparian owners is governed by the same principles as those in relation to easements in land, and in order to establish such right there must be a perceptible amount of injury throughout the period necessary to gain such right.

The court further quoted from Holsman *v.* Boiling Spring Bleaching Co. (1 McCarter 335) to sustain its position.

It would seem that the premises of the court, namely, that a prescriptive right can not accrue except during the period when actual injury is caused, is erroneous. It is true that the very nature of a prescriptive right is such that it can only arise from an invasion of a legal right throughout the entire statutory period, but legal right is not synonymous with actual injury, and it has been held repeatedly that even when no actual injury is caused by the upper riparian proprietor he may even yet be enjoined where the right of the lower owner is invaded and this for the very purpose of preventing the adverse use from ripening into a prescriptive right. Parker *v.* American Woolen Co. (195 Mass. 591) is a conspicuous instance of the grant of such relief even though the complainant's present use of the stream was not such as that he suffered actual injury. It would seem to follow that the plaintiff's predecessors in title must have had the right to enjoin these defendants, and, that if they failed to do so, the prescriptive right must have accrued.

Further, if the court's position be correct it would seem to follow that no right by prescription could be acquired in any case unless and until it had been acquired against lower proprietors actually making such use of the stream as requires the highest degree of purity in the water.

In the case of Ulbricht *v.* Eufaula Water Co. (86 Ala. 587; 6 So. 78; 4 L. R. A. 572; 11 Am. St. 72), decided 1889, there was no question of pollution involved, the action being one for diversion of water, but the reasoning would apply with equal force to a suit where the injury was caused by pollution. In that case—

* * * The grievance complained of is that the defendant, an upper riparian owner, by the construction of a dam and a reservoir, and the diversion of so large a quantity of the running stream, is guilty of an unlawful act prejudicial to the rights of the complainant, as a lower riparian owner on the same stream.

The suit was to enjoin this diversion. The court said:

The testimony fully establishes the diversion of the water for the purpose mentioned, resulting in a sensible diminution in the flow of the stream, at least in the dry season or summer months. It further shows, however, that the complainant was making no particular use of the stream, having no mill or other industry on it, and therefore that he suffered no special damage by the act of defendant. The chancellor was of opinion "that the owner below ought not to be permitted by injunction to hinder the owner above from the consumption of water which the former can not and does not use." An injunction was nevertheless granted, "perpetually restraining the defendant from the consumption of the whole or any part of said stream for the use of said waterworks in supplying the city, to the sensible injury or damage of the complainant, for any purpose for which he may now or in the future have use for said water." The defendant was also enjoined from backing any portion of the water of the stream on the lands of the complainant to an extent damaging to him. The chancellor admited the right of the complainant also to prevent the defendant from so using the water as to acquire an easement by an adverse user of any or all the water of the stream for supplying said waterworks, and the complainant is declared to be entitled to the reasonable use of the flowing waters of said stream, as against the defendant, whenever he shall need it. It is our opinion that there is no error in this decree, and that it secures to the complainant all that to which he is equitably entitled in this suit. * * *

It is our opinion that the aid of injunctive relief was carried by the chancellor's decree as far as it ought to be, in view of the facts of this case. It fully protects the complainant from injury, present and future, resulting from the use of the water by the defendant—a privilege of inestimable value to defendant and of no special value to the complainant. The granting of the injunction in the broad terms asked would be of great inconvenience and even injury to the defendant, without being of any corresponding benefit to complainant.

The decree is affirmed.

It would seem that this disposition of the controversy has much to commend it. The injunction established the complainant's right to the flow of water and prevented the acquisition by the defendant of any prescriptive right. The water company was not enjoined against diverting the water, so long as such diversion should continue to be harmless. On the other hand, it was not permitted to divert the water to the interference of any use of the stream which the complainant might see fit to make. Had the court granted an absolute injunction against any diversion of the water that would interfere with the abstract right of the complainant, it would have placed the water company in a position where it would have been at the mercy of the complainant and might have been forced either to abandon its operations and its investment or buy off the complainant at his own price. While it would seem on the one hand that a riparian owner's rights of the stream ought not to be limited to the mere extent of his present use, yet on the other hand, if his right to future use is preserved by the terms of injunction, how can he complain that the defendant has not been forced to abandon operations before the necessity arises?

IN SUITS FOR INJUNCTION AGAINST POLLUTION OF STREAMS THE GENERAL RULE THAT A NUISANCE WILL NOT BE ENJOINED IN AN EQUITY SUIT UNTIL ITS EXISTENCE HAS FIRST BEEN ESTABLISHED IN AN ACTION AT LAW DOES NOT OBTAIN, THE REASON BEING THAT THE DELAY INCIDENT TO THE ESTABLISHING OF THE RIGHT IN AN ACTION AT LAW MIGHT CAUSE IRREPARABLE INJURY.

In the case of the Village of Dwight *v.* Hayes (150 Ill. 273) the court said:

* * * The decree of the circuit court dismissing the bill is sought to be sustained on the ground that before the complainant is entitled to an injunction he must bring his suit at law and have his right determined by a jury. While it is a general rule, and one which was formerly enforced with very considerable strictness, that before a court of equity will interfere by injunction to restrain a private nuisance the complainant must establish his right in a court of law, that rule has in modern times been somewhat relaxed. In Oswald *v.* Wolf (129 Ill. 200), in discussing this branch of equity jurisdiction, we said: "Even this power was formerly exercised very sparingly and only in extreme cases, at least until after the right and question of nuisance had been settled at law. While in modern times the strictness of this rule has been somewhat relaxed, there is still a substantial agreement among the authorities that to entitle a party to equitable relief before resorting to a court of law his case must be clear, so as to be free from all substantial doubt as to his right to relief."

We are disposed to think that the complainant's case is one which, within the rule as thus laid down, entitles him to an injunction without having first established his right at law. None of the substantial facts upon which his right rests are controverted. * * *

* * * That the sewage of a village of 1,600 inhabitants discharged into a small stream will materially pollute the water of the stream and render it unfit for domestic use for at least a few rods below the point of discharge is a proposition too plain and too thoroughly verified by ordinary experience and observation to admit of reasonable doubt. That such disposition by the village of its sewage will create and constitute a nuisance per se is a proposition too plain for serious question. * * *

In the case of Lockwood Co. *v.* Lawrence (77 Me. 297) the court discussed this question at some length, and its conclusion that it is not necessary to establish the existence of a nuisance in a suit at law before suing at equity where the injury would be irreparable, it is sustained by the authorities which the court cites. The following is from the opinion:

* * * It is well settled that private nuisances may, under some circumstances, fall within the jurisdiction of a court of equity in reference to obtaining relief from further molestation by restraining the acts which constitute the nuisance.

Nuisances and injuries affecting waters, including the obstruction, diversion, or pollution of streams, afford frequent ground for equitable interference on the principle of restraining irreparable mischief. The jurisdiction of equity in this class of cases may be regarded as ancient and well established. Especially is this true when the acts complained of are of such a character

that irreparable injury will result to the complainant without such interference or when adequate compensation for the injury arising therefrom may not be obtained at law, or, if continued, would lead to a multiplicity of suits. Whenever this is admitted or established by proof a court of equity may, by injunction, restrain the continuance of such acts. (Caufield *v.* Andrew, 54 Vt. 1.)

It is true that "it is not every case which would furnish a right of action against a party for a nuisance which will justify the interposition of a court of equity to redress the injury or remove the annoyance." (Story, Eq. Jur. 925.) And the general rule, as claimed by the learned counsel for the respondents, is that where a nuisance is claimed to exist the fact of its existence should, ordinarily, be established by a suit at law before a court of equity will interfere. This rule, however, is not without exceptions. The ground upon which equity takes jurisdiction is that the injury complained of is irreparable or of such a nature that there is no adequate remedy at law. An examination of the cases which sustain the doctrine of the necessity of the prior interposition of an action at law admit that in cases of pressing or imperious necessity, or where the right is in danger of being injured or destroyed, or there is no adequate remedy at law, equity will intervene. (Varney *v.* Pope, 60 Maine, 195; Porter *v.* Whitham, 17 Maine, 294; Morse *v.* Machias Water Power Co. 42 Maine, 127, 128; Parker *v.* Winnipiseogee Lake Co. 2 Black, 552; Coe *v.* Winnipiseogee M'f'g. Co. 37 N. H., 263; Gould on Waters, 506, and cases cited.)

As stated by Chancellor Kent in Gardner *v.* Newburgh (2 Johns. ch. 165): "The foundation of jurisdiction in such a case is the necessity of a preventive remedy when great and immediate mischief or material injury would arise to the comfort and enjoyment of property." The fact that the complainant has not established his right at law is no ground for demurrer to the bill. (Soltau *v.* De Held, 2 Sim. N. S. 133; Robeson *v.* Pittenger, 1 Green. ch. 57; Holsman *v.* Boiling Spring Co. 1 McCarter, 335; Olmsted *v.* Loomis, 9 N. Y. 432.)

And by irreparable injury is meant one for which there is no adequate remedy at law. (Gould on Waters, 508.) "To deprive a plaintiff of the aid of equity by injunction it must also appear that the remedy at law is plain and adequate; in other words, that it is as practical and efficient to secure the ends of justice and its proper and prompt administration as is the remedy in equity. And unless this is shown a court of equity may lend its extraordinary aid by injunction, notwithstanding the existence of a remedy at law." (1 High on Inj. 30; Boyce's Exr's *v.* Grundy, 3 Pet. 215.) Especially is this the case where the injury is of such a nature as from its continuance or permanent mischief must cause a constantly recurring grievance which can not otherwise be prevented. (Adams, Eq. 211; Belknap *v.* Trimble, 3 Paige, 601; Webber *v.* Gage, 39 N. H. 186, 187; Merrifield *v.* Lombard, 13 Allen, 18; Cadigan *v.* Brown, 120 Mass. 494.) In such case an action at law affords no adequate remedy, and vexatious litigation and multiplicity of suits, which equity seeks to avoid, would afford just grounds for equitable interference. (Clark *v.* Stewart, 56 Wis. 154.) The very difficulty of obtaining substantial damages was stated to be a ground for relief by injunction in Clowes *v.* Staffordshire Potteries Co. 8 L. R. Ch. Ap. 125. * * *

* * * The court in Massachusetts has very recently had occasion to allude to this question in a case relating to the rights of riparian owners where the waters in a natural stream were polluted, in which case the court say: "The defendant contends that, according to the general principles of the common law, the plaintiff has a complete remedy upon the facts alleged by him, and that he should be compelled to resort to his action at law before seeking relief

in equity. But it is quite clear that a bill in equity may be maintained by a riparian owner to restrain another from polluting the stream to the plaintiffs' material injury. (Merrifield *v.* Lombard, 13 Allen, 16; Woodward *v.* Worcester, 121 Mass. 245.) The acts of the defendant, as alleged, tend to create a nuisance of a continuous nature, for which an action at law can furnish no adequate relief." (Harris *v.* Mackintosh, 133 Mass. 280.)

Equity, as well as the common law, has growth. It is said that prior to Lord Eldon's time injunctions were rarely issued by courts of equity, but that with the development of equity jurisprudence it has become of frequent use. In the earlier history of the jurisprudence relating to this branch of the law, it was rarely issued in the case of a private nuisance until the plaintiff's right had been established in a suit at law. "But now," say the court in Campbell *v.* Seaman (63 N. Y. 582), "a suit at law is no longer a preliminary, and the right to an injunction, in a proper case, in England and most of the States, is just as fixed and certain as the right to any other provisional remedy. The writ can rightfully be demanded to prevent irreparable injury, interminable litigation, and a multiplicity of suits."

And in Beach *v.* Sterling Iron & Zinc Co. (9 Dick (N. J.) 65), the court said:

* * * The object and office of a verdict and judgment at law is to establish the right and give compensation for past injuries. The right being once made clear, whether by judgment at law or upon incontrovertible rules of law and well-established facts, the remedy in equity by injunction to prevent future injury is a matter of right, and the relief can not be refused * * *."

WHERE THE EFFECT PRODUCED BY THE POLLUTION OF A STREAM AMOUNTS TO A PUBLIC NUISANCE, THE STATE BY ITS ATTORNEY GENERAL MAY BRING AN ACTION FOR AN INJUNCTION AGAINST THE CONTINUANCE OF THE POLLUTION.

In a very important case that arose in Michigan, a careful and painstaking opinion was written by Mr. Justice Stone, in the course of which he said:

If the city of Grand Rapids in emptying its sewage into Grand River, as shown by the evidence, creates a nuisance to the public or riparian proprietors below the city, the continuance or creation of that nuisance may properly be restrained by injunction, and the attorney general is a proper complainant.

In Missouri *v.* Illinois (180 U. S. 208, 21 Sup. Ct. 331, 45 L. Ed. 497) a bill to restrain the pollution of the waters of the Mississippi River by emptying into it the sewage of Chicago, through the drainage canal, was demurred to; two of the grounds being that it was not a proper subject for an injunction, and that, as the State was not interested, it was not properly instituted by the attorney general on its behalf. The United States Supreme Court overruled the demurrer, and held that the proceeding did affect the public at large, presented a case for equitable inquiry, and stated, among other things: "The health and comfort of the large communities inhabitating those parts of the State situated on the Mississippi River are not alone concerned, but contagious and typhoidal diseases, introduced in the river communities, may spread themselves throughout the territory of the State. Moreover, substantial impairment of the health and prosperity of the towns and cities of the State situated on the Mississippi River, including its commercial metropolis, would injuriously affect the entire State." The court further said, quoting from Attorney General *v.* Jamaica

Pond Aqueduct Corporation (133 Mass. 361): "The cases are numerous in which it has been held that the attorney general may maintain an information in equity to restrain a corporation, exercising the right of eminent domain under a power delegated to it by the legislature, from any abuse or perversion of the powers which may create a public nuisance or injuriously affect or endanger the public interests"—citing many cases. (Attorney General *v.* City of Grand Rapids, 175 Mich. 503, 141 N. W. 880, decided May 28, 1913.)

AS AGAINST A LOWER RIPARIAN PROPRIETOR A RIGHT TO POLLUTE A STREAM MAY BE ACQUIRED BY PRESCRIPTION.

In Alabama Consolidated Coal & Iron Co. *v.* Turner (145 Ala. 639), the action was for damages for taking water from a running stream and for polluting the same by allowing to be discharged therein polluting matter from the ore washers of the mining company. The defendant company pleaded the statute of limitations, claiming that it had used the waters of the creek for more than 10 years before the commencement of the suit in substantially the same manner as at the time the suit was brought and had thus acquired the right as against the plaintiff so to use the water. The plaintiff demurred to this plea and its demurrer was sustained by the lower court, but upon appeal the Supreme Court said:

* * * In this we apprehend the court erred. The question seems to have been definitely settled in Stein *v.* Burden (24 Ala. 148, 60 Am. Dec. 453), and approval by other adjudications of the court. As was then said: "It is the established doctrine that the exclusive enjoyment of the water, or any other easement, in a particular way, for the length of time which is the period of statute of limitations, enjoyed without interruption, is sufficient to raise a presumption of title, as against a right in any other person, which might have been but was not asserted." Ulbricht *v.* E. W. Co. 86 Ala. 592, 6 South. 78, 4 L. R. A. 572, 11 Am. St. Rep. 72; Crabtree *v.* Baker, 75 Ala. 91, 51 Am. Rep. 424; Mininger *v.* Norwood, 72 Ala. 285, 47 Am. Dec. 412; Wright *v.* Moore, 38 Ala. 593, 82 Am. Dec. 731.)

Angell on the Law of Water Courses, 205, holding to the doctrine that any man has the right to have the advantage of a flow of water on his own land without diminution or alteration, lays down the doctrine that an adverse right may exist founded on the occupation of another, stating: "And although the stream be either diminished in quantity, or even corrupted in quality, as by means of the exercise of certain trades, yet if the occupation of the party so taking and using it has existed for so long a time as may raise the presumption of a grant, the other party, whose land is below, must take the stream subject to such adverse right." Am. & Eng. Ency. Law (2d Ed.) 875; 22 Am. & Eng. Ency. Law (2d Ed.) 1187.

BUT WHERE A RIGHT BY PRESCRIPTION IS ACQUIRED, IT IS LIMITED TO THE USE ACTUALLY MADE DURING THE ENTIRE STATUTORY PERIOD.

In Goldsmid *v.* Tunbridge Wells Improv. Commissioners (L. R. 1, ch. 349) an action was brought against the defendant sewer commissioners to restrain them from continuing to permit the sewer

drainage from the town of Tunbridge Wells to flow into Calverley Brook to the injury of the plaintiff, who was a lower proprietor on the brook. The defendants claimed a right by prescription, and it appeared that for some years the sewage had been discharged into the stream, but that only within the few years next preceding the filing of the bill had the water become foul and unwholesome, the reason being that the population of the city had greatly increased within those years.

And the court held that no prescriptive right had been acquired, that such right could only be acquired, if at all—

> by a continuance of the discharge of the sewage prejudicially affecting the estate, at least to some extent, for the period of 20 years,

and found from the evidence that the estate had not been prejudicially affected for so long a period.

In City of Richmond *v.* Test (18 Ind. App. 482), while upholding the right of the city to discharge its sewage into the stream, refused to allow such right to rest upon the ground of prescription. In that case, the city had greatly increased the amount of sewage which had been dumped into the stream and had also decreased the capacity of the stream within a short time before the commencement of the action. The court held that the prescriptive right of the city would be limited to the use made of the stream at the beginning of the statutory period.

And in Prentice *v.* Geiger (74 N. Y. 341), at page 346, Judge Andrews said:

> Upon the question of prescription, the court charged the jury, in substance, that to constitute a right in the defendant by prescription to throw the sawdust into the stream, there must have been a continued exercise of the right for the period of 20 years, without any substantial change, and that if there was a material change in the use from the time the mill was changed to a steam mill, whereby the injury to the plaintiff was occasioned, the defense founded upon prescription was not established. The charge was in accordance with the settled law upon the subject. The right acquired by prescription is commensurate with the right enjoyed. The extent of the enjoyment measures the extent of the right. The right is supposed to have had its origin in a grant, and the grant being lost, the user is the only evidence of the right granted, and as the presumption of a grant only exists where there has been an adverse, continuous, and uninterrupted user, according to the nature of the easement claimed, for the period of 20 years, the prescriptive right is confined to the right as exercised for that period of time. The party claiming a prescriptive right can not, within the 20 years, enlarge the use, and at the expiration of that time claim not only the use originally enjoyed, but that use as supplemented and enlarged within the period of prescription.

In Kraver et al. *v.* Smith (164 Ky. 674), at page 685, it was said:

> Proof was introduced by the appellant, Kraver, which tended to show that the distillery operated by him was located near the creek in 1880, and that its

slops had been continuously discharged into the creek up to August, 1912, but the proof further shows that the character of the slops which went into the creek previous to the year 1908 or 1909 did not pollute the waters nor create a nuisance, and it was only the character of the slops which had gone from the distillery into the creek since 1908 which polluted the stream and created the nuisance complained of.

It has been held that one creating a nuisance is liable to anyone who is injured by it, but one merely continuing a nuisance as the purchaser of property which is a nuisance is not liable until he is requested to abate it. (Ray v. Sellars, 1 Duvall 256; West v. L. & N. R. R., 8 Bush. 406.) The proof, however, showed that Kraver created this nuisance or assisted to create it within five years before the bringing of the suits by discharging into the creek a different kind of slop, with other ingredients, than that used theretofore, and besides had been sued for the same character of injuries before the bringing of these suits, and hence could not claim to be a mere continuer of a nuisance.

Other cases in support of the above holding are:

Baxendale v. McMurray, L. R. 2, ch. 790; decided 1867. Bealey v. Shaw, 6 East. 207; decided 1805. Snow v. Parsons, 28 Vt. 459; decided 1856. Merrifield v. Lombard, 13 Allen (95 Mass.), 16.

In the case of Attorney General v. City of Grand Rapids it was said:

The doctrine of prescriptive right does not apply here for two reasons: First, there can be no prescriptive right to create a public nuisance; and, second, there has been a great increase of the discharge of sewage into the river within the 15 years before the bill was filed. (30 Am. & Eng. Ency. of Law (2d ed.), 383.)

In Goldsmid v. Tunbridge Wells Imp. Co. (L. R. 1, ch. 349) the pollution of a stream by the discharge of sewage from a town therein which was complained of had been going on for over 20 years, and was continuous, and was sought to be maintained on the ground of prescriptive right. It was held, however, that such prescriptive right had not been acquired, because during the early period the discharge of the sewage did not prejudicially affect the lower riparian owners on account of the small amount discharged, and became prejudicial only when, from the increase in the size of the town, a greater amount was discharged.

The prescriptive right to pollute the water is limited to the use which has been made of it, and, in case new use is attempted which renders the stream much more foul, the lower proprietor may recover for the injury done him. (Moore v. Webb, 1 C. B. (N. S.) 673.) * * *

If a perspective right has been acquired to pollute the water to some extent, the one having the right will not be permitted to increase the pollution without being liable to an action. (McIntyre v. McGavin (1893) A. C. 268.)

A RIGHT TO CREATE A PUBLIC NUISANCE CAN NOT BE ACQUIRED EVEN BY PRESCRIPTION.

In Nolan v. New Britain (69 Conn. 668), decided 1891, the defendant city set up the defense of a right by prescription to pollute the stream known as Pipers Brook, which flowed through the plaintiff's premises, the court said:

The sixth defense presents the question of prescription. We have already indicated our opinion that the use of Pipers Brook, of which the plaintiff complains, is a public nuisance. We suppose the law to be so that a public nuisance can not be prescribed for. No length of time can legitimate, or enable a party to prescribe for, a public nuisance. (People *v.* Cunningham, 1 Denio, 524; Mills *v.* Hall, 9 Wend. 315; Venzie *v.* Dwinel, 50 Me. 479, 490; Commonwealth *v.* Upton, 6 Gray, 471, 476; Wood on Nuisances, 722; 19 Amer. & Eng. Ency. of Law, 30.) When an action is brought by a party who has suffered a special injury in consequence of a public nuisance, a prescriptive right to do the acts complained of can not be maintained against him. (Bowen *v.* Wendt, 103 Cal. 236; People *v.* Gold Run. etc., Mining Co., 66 Cal. 138; Boston Rolling Mills *v.* Cambridge, 117 Mass. 396; O'Brien *v.* St. Paul, 18 Minn. 176; Cooley on Torts, 614.)

In Kraver *v.* Smith (164 Ky. 674), at page 684, it was said:

The claim of a prescriptive right on the part of the appellants to run their sewage into the creek, and for that reason they were not liable in damages for a nuisance created by it, was not allowed by the trial court, and properly so, because there was no evidence offered upon which to base such a claim. The city, upon its part, offered no evidence upon that subject at all, and, if it had, it could not have been allowed as a defense, because, while the owners of the lands adjacent to the creek would have no right at any time to complain of the discharge from the city into the creek of the surface waters, which would naturally find an outlet into the creek, neither the city nor could Kraver claim to have a prescriptive right to turn the filth of the sewers, human excrement, slops, and other poisonous things into the stream. (City of Henderson *v.* Robinson, 152 Ky. 245.) * * *

In 29 Cyc. 1207, the doctrine is thus stated: "There is no such thing as a prescriptive right to maintain a public nuisance, and hence prescription is no defense to a proceeding to abate a nuisance, either by public authorities or by a private individual for damages for the injury which he has received, or to an indictment against the person maintaining the nuisance."

And in the case of Attorney General *v.* City of Grand Rapids it was said:

* * * There can be no prescriptive right to pollute a stream by the discharge of sewage in such a manner and to such an extent as to be injurious to public health. Even assuming that a prescriptive right to foul a stream with sewage can be acquired, such must be restricted to the limits of it when the period of prescription commenced; and if the pollution be substantially increased, whether gradually or suddenly, the court will interfere by injunction to prevent the wrongful excess; and, if it be impossible to separate the illegal excess from the legal user, the wrongdoer must bear the consequences of any restrictions necessary to prevent the excess, even if it unavoidably extends to the total prohibition of the user. (Blackburne *v.* Somers, L. R. Ir. 5 Eq. 1.) * * *

No person is entitled on the ground of ancient custom to the privilege to collect a mass of sewage matter and pour it at one point into a stream in such a quantity that the river can not dilute it on its passage down to the lower riparian proprietors, as the effect of such an act is to create an evil which must be illegal, being such as no custom can authorize. (Attorney General *v.* Richmond, L. R. 2 Eq. 306.)

NOR CAN A RIGHT BY PRESCRIPTION BE ACQUIRED WHICH WILL AUTHORIZE THE DOING OF ANYTHING FORBIDDEN BY STATUTE.

In Lewis *v.* Stein (16 Ala. 24), a statute entitled "An act to incorporate an aqueduct company in the city of Mobile," provided that any person who should obstruct or injure the water of Three Mile Creek by rocks, logs, or other materials between its source and the place where the water is taken for the use of the city, should forfeit the sum of $20 to be proven by an action of debt.

Defendant had operated a sawmill on the protected portion of this stream for more than 30 years. He was sued under the section for the forfeiture.

The court points out that a number of courts have held that no prescriptive right to create a public nuisance can accrue, but finds it unnecessary to indorse the principle or apply it to this case because of the fact that the act under which the suit was brought was passed only a short time after the mill was erected, and the holding is that—

> We then have the clear and unequivocal evidence of the legislative will that no one shall injure the water of this particular stream. In objection to this act prohibiting an injury to the water we can not infer a grant or authority to do so in violation of the act.

BY THE GREAT WEIGHT OF AUTHORITY, MUNICIPALITIES HAVE NO GREATER RIGHTS THAN INDIVIDUALS TO POLLUTE WATERCOURSES AND MUST RESPOND IN DAMAGES FOR ANY INJURY CAUSED TO A LOWER RIPARIAN PROPRIETOR AND MAY BE ENJOINED FROM CONTINUING THE POLLUTION.

The cases are very numerous in which municipalities have been held responsible for injuries caused by the emptying of sewage into streams without purification. Among the most concise and emphatic expressions found in the decisions is one by Mr. Justice Hamersley in the case of Platt Bros. & Co. *v.* City of Waterbury (72 Conn. 531; 48 L. R. A. 691), decided January 4, 1900, where the following language was used:

> The right to pour into the river surface drainage does not include the right to mix with that drainage noxious substances in such quantities that the river can not dilute them, nor safely carry them off without injury to the property of others. The latter act is in effect an appropriation of the bed of the river as an open sewer, and the proposition that it may become lawful by reason of necessity is inconsistent with undoubted axioms of jurisprudence. The appropriation of the river to carry such substances to the property of another is an invasion of his right of property. When done for a private purpose, it is an unjustifiable wrong. When done for a public purpose, it may become justifiable, but only upon payment of compensation for the property thus taken. Public necessity may justify the taking, but can not justify the taking without compensation. It may be necessary for a city to thus mix with its drainage such substances, but it is not necessary to pour such mixture into the river without purification. Indeed, the purification is coming to be recognized as a

necessity. But, however great the necessity may be, it can have no effect on the right to compensation for property taken. The mandate of the constitution is intended to express a universally accepted principle of justice, and should receive a construction in accordance with that principle, broad enough to enable the court to protect every person in the rights thus secured by fundamental law.

In the case of Winchell *v.* Waukesha (110 Wis. 101; 85 N. W. 668; 84 Am. St. Rep. 902), which was an action to recover damages and an injunction against the defendant city which was polluting the Fox River to the injury of the plaintiff, causing disagreeable odors to arise therefrom and rendering the water unfit for bathing or for watering stock, the Supreme Court of Wisconsin granted an injunction preventing the city from discharging any sewage into the stream "unless the same shall have first been so deodorized and purified as not to contain foul, offensive, or noxious matter capable of injuring the plaintiff or his property or causing nuisance thereto." In the opinion the court cited with approval language from some of its earlier decisions. The following from Harper *v.* Milwaukee (30 Wis. 365, 372) was quoted:

* * * The general rule of law is that a municipal corporation has no more right to erect and maintain a nuisance than a private individual possesses, and an action may be maintained against such corportion for injuries occasioned by a nuisance for which it is responsible in any case in which, under like circumstances, an action could be maintained against an individual.

And also the following language from Hughes *v.* Fond du Lac (73 Wis. 380, 41 N. W. 407):

A municipal corporation is no more exempt from liability in case it creates a nuisance, either public or private, than an individual.

The case of Chapman *v.* City of Rochester (110 N. Y. 273) is one that has frequently been cited to sustain the liability of the city for injury caused by its sewage. The following is from the opinion of the court in that case:

The plaintiff was the owner and occupant of certain premises, containing more than 4 acres of land in the town of Brighton, adjoining the city of Rochester, and watered by a stream known as Thomas Creek, which, rising in that city and fed by springs of pure water, ran northwardly and across the plaintiff's premises into Irondequoit Bay. He collected its water into an artificial basin, making it serve as well for domestic uses as the propagation of fish, and from it, in due season, he also procured a supply of ice.

The defendant thereafter constructed sewers, and through them discharged not only surface water, but the "sewage from houses and the contents of a large number of water-closets" into Thomas Creek, above the plaintiff's land, with such effect as to render its water unfit for use and cover its banks with filthy and unwholesome sediment. These and other facts well warranted the conclusion of the trial court that the act of the defendant in thus emptying its sewers, constituted an offensive and dangerous nuisance.

Moreover, the plaintiff is found to have sustained a special injury to his health and property from the same cause, and we find no reason to doubt that he is entitled not only to compensation for damages thereby occasioned, but also to such a judgment as will prevent the further perpetration of the wrong complained of. (Goldsmith *v.* Commissioners, 1 Eq. Cas. 161, 1 Ch. App. Cas. 848.)

In view of the principle upon which these and like decisions turn, the objections of the learned counsel for the defendant, against the judgment appealed from, are quite unimportant. The filth of a city does not flow naturally to the lands of the plaintiff, as surface water finds its level, but is carried thither by artificial arrangements prepared by the city and for which it is responsible.

In the case of the Village of Dwight *v.* Hays (150 Ill. 253), decided 1894:

Plaintiff was the owner of a stock farm on a creek below the village of Dwight. The creek was a small one which was dry part of the year. The village proposed to install a sewer system by which all its sewage would flow into the stream a short distance above the plaintiff's property. The village had a population of 1,600. Plaintiff sued to enjoin the installation of this sewer. It appeared that plaintiff was in the habit of cutting ice from this creek and that his stock were watered there.

There was some testimony tending to show that the effect of the sewer would not be to pollute the stream to such an extent as to create a nuisance, but the Supreme Court practically took judicial notice of the fact that the amount of sewage of a village of this size dumped into a small stream would create a nuisance, and expressly stated:

"Little weight is to be given to the testimony of witnesses who attempt to swear contra to known and established natural laws * * *. That such disposition by the village of its sewage will create and constitute a nuisance *per se*, is a proposition too plain for serious consideration."

The court held that it was a proper case for an injunction, and cited, with approval, Gould on Waters, section 546, to the effect:

"The fact that a large population will be affected by the interruption of the system of sewers is immaterial, where the rights of an individual are invaded."

In the case of the Attorney General *v.* City of Grand Rapids et al. (177 Mich. 503, 141 N. W. Rep. 890), the attorney general of Michigan brought suit against the defendant city upon the relation of the township of Wyoming and the village of Grandville, which are situated below the defendant city on Grand River. The suit was for the purpose of enjoining the defendant city from emptying its sewage into the stream. It appeared that the stream was very seriously polluted by the sewage from the city and that it was proposed to increase the amount of sewage by the installation of new sewers by which there would be disposed of sewage from a large area, from which it has been customary to take the sewage out into the country and bury it. Voluminous testimony was taken and the court found the existence of a nuisance as a matter of fact, and held that, the city having created the nuisance to the public, injunction was the proper remedy and the attorney general the proper complainant. The court—

further held that the fact that the city of Grand Rapids is one of considerable size which must in some way dispose of its sewage, gives it no right superior to that of the ordinary riparian owner to the use of the stream.

The opinion of the court concludes:

* * * The maxim, "use your own property in such a manner as not to injure that of another," can equitably be applied to the defendants in this case. It appears undisputed that the construction of a septic tank or tanks by the defendants within a reasonable time is feasible and practicable, and that thereby the sewage would be relieved from contaminating properties and so purified as to take away the offensive, unhealthful, and nauseating odors.

The decree of the court below will be reversed, and one entered here for complainants, restraining the defendant, the city of Grand Rapids, its boards, officials, servants, and agents from continuing to discharge the sewage of the city of Grand Rapids, which is now discharged into the said Grand River, until the same shall have first been, by the use of the septic tank or tanks, so deodorized and purified as not to contain the foul, offensive, or noxious matter (which it now contains) capable of injuring the complainants or their property, or causing a nuisance thereto; such injunction to become operative one year after the date of the settling of decree. The complainants will recover of the defendant, the city of Grand Rapids, their costs of both courts, to be taxed and duly certified.

In Joplin Consolidated Mining Co. *v.* City of Joplin (124 Mo. 129, 27 S. W. 408), it was said:

The proprietor of land through which a stream flows can not insist that the water shall come to him in the natural, pure state. He must submit and that, too, without compensation, to the reasonable use of it by the upper proprietors and he must submit to the natural wash and drainage coming from cities and towns. But a city has no right to gather its sewage together and cast it into a stream so as to injure the lower proprietor. For damages thus sustained the lower proprietor will have an action, and in many instances injunctive relief. (Locks & Canals *v.* City of Lowell, 7 Gray 223; Hoskell *v.* City of New Bedford, 108 Mass. 208; Von Mills *v.* Nashua, 63 N. H. 136; Chapman *v.* City of Rochester, 110 N. Y. 273; 18 N. E. 88, Lewis Em. Dom. Sec. 65.)

Cited with approval in Markwardt *v.* City of Guthrie (18 Okla. 32, 39).

Even in Pennsylvania where the right of a mining company to pollute a stream to the extent of destroying practically all of the beneficial uses of a lower riparian proprietor, having a home on the stream and using the same for domestic purposes, was upheld on the grounds that the defendant mining company was making a natural use of the stream and that the industry was an important one to the public, the same court refuses to extend a similar immunity from liability to a city polluting a stream by sewage to such an extent as to destroy the beneficial uses of a lower proprietor. The following is the opinion of the Supreme Court of Pennsylvania:

Little need be said either in explanation or in vindication of the judgment in this case. The plaintiff is the owner of a farm situated 3 miles from Altoona, through which a stream known as Mill Run passes. The bed of the stream is limestone rock, through seams and fissures in which a part of the water finds

a subterranean passage and feeds two springs near the farm buildings, from which water is procured for the stock and for domestic purposes.

The city of Altoona constructed sewers, the contents of which flow into this stream, with the result to the plaintiff that the water of the stream and of the springs is so polluted as to be unfit for any use, and at times when the water overflows the banks of the stream deposits of filth are left on his fields. By digging wells he has been unable to obtain pure water, as on account of the crevices in the rock the whole underground supply is polluted, and he is unable to obtain water for use on his farm, except from a great distance and at great expense.

The assignments of error raise two questions: First, whether there is any liability on the part of the defendant; and, second, whether the recovery, if any can be had, shall be for a permanent injury. These questions were both properly submitted at the trial, and the jury found that the act of the defendant destroyed or seriously impaired a property right which the plaintiff possessed in a stream, and that there was no practicable method by which this injury could in the future be averted, and that it was continuing and permanent.

The fact that the stream has a partially subterranean course does not affect the right of the plaintiff, as the location of the part of the stream below the surface is well defined and easily ascertained.

Pennsylvania Coal Co. *v.* Sanderson (113 Pa. 126) presented an entirely different question. It was there said: "It will be observed that the defendant has done nothing to change the character of the water or to diminish its purity, save what results from the natural use and enjoyment of their own property. They have brought nothing on to the land artificially. The water as it flowed into Meadow Brook is the water which the mine naturally discharges; its impurities arise from natural and not artificial causes." And the decisions in Howell *v.* McCoy (3 Rawle, 256), Barclay *v.* Commonwealth (25 Pa. 503), and McCollum *v.* Germantown Water Co. (54 Pa. 40), holding that a stream of water may not be fouled by the introduction into it of any foreign substance to the injury of a lower riparian owner, were expressly recognized.

The judgment is affirmed.

The case of Peterson *v.* City of Santa Rosa perhaps goes further than any that has been found in restraining a city from injuring a stream by its sewage. In that case the plaintiff owned a farm below the defendant city on Santa Rosa Creek, into which stream the city discharged sewage. The effect of the sewage was to cause disagreeable odors to arise from the waters at times and to render the water, which had formerly been pure and fit for household purposes and for the watering of stock, impure and unfit for those uses. The suit was for damages and injunction. It was held that the damages caused by the city were unascertainable, because there were other sources of pollution and that it would not be possible to separate the damage caused by the defendant from that caused by others, but nominal damages were granted.

It appeared that after the suit was begun the defendant commenced to install a sewage disposal plant and that the same was in operation before the trial with the result that the sewage, after passing through it—

was clear and inodorous, but the evidence does not show whether or not it was then palatable or fit for use.

The California Supreme Court said:

As will be seen by the finding, the sewage, as treated by defendant, has rendered the water clear and inodorous, but the question as to whether or not it is potable or fit for use remains undetermined for want of evidence upon which to base a deduction.

The previous findings on this question were against the defendant, and, as the burden of showing a change rested upon the defendent, we must presume, in the absence of proof, that the water in the respect indicated has not undergone a change.

The case then stands thus: Plaintiff, as the owner of lands through which the water of Santa Rosa Creek flowed had, and still has, a right of property in the waters of the stream. This right is a corporeal hereditament, appurtenant to the land and running with it. (Alta Land Co. *v.* Hancock, 85 Cal. 219; 20 Am. St. Rep. 217.) Her right as a riparian owner was not only to have the water of the stream flow over her land in its usual volume, but to have it flow in its natural purity, and such pollution of the stream by the defendant as substantially impaired its value for the ordinary purposes of life, and rendered it measurably unfit for domestic purposes, is an actionable nuisance, and the fact that the defendant is a municipal corporation does not enhance its rights or palliate its wrongs in this respect. (Wood on Nuisances, sec. 427; High on Injunctions, 3d ed., sec. 810.)

We regard the present case as a close one, but under the findings, which are not challenged, we can not interfere with the conclusion reached by the court below.

In Grey ex rel Simmons *v.* Paterson, the attorney general of New Jersey brought suit against the defendant city to enjoin the emptying of its sewage into the Passaic River.

The chancellor found that the sewage created a public nuisance and granted an injunction. Upon appeal the court of errors and appeals held that the city had no right to take without compensation the property right of lower riparian owners on the stream above tide water, to have the waters of the stream come down to them without unreasonable pollution.

But the court, while holding that as a necessary sequence to the establishment of such a right frequently an injunction would be granted, yet held that in view of the fact that the city of Patterson was one of upward of 100,000 inhabitants, and that the lower riparian owners, upon whose behalf the action was brought, had acquiesced in the pollution of the stream by the city, that it would be inequitable to grant an injunction. And the court instructs those upon whose behalf the suit was brought to amend their bill or file a new one asking for an injunction in case the city refuses to make compensation or to sue at law for damages.

It is to be noted that the ground for the denial of equitable relief was not the fact that the sewerage had been constructed under governmental authority.

A MUNICIPALITY IS NOT LIABLE FOR THE POLLUTION OF A STREAM CAUSED BY THE ORDINARY DRAINAGE OF SURFACE WATER.

It has been seen that a municipality has no greater right than an individual to cast polluting matter into a stream. It has also been seen, however, that an individual is not liable for the pollution of a stream caused by the ordinary drainage of surface water from his land. So in the case of the municipality, a distinction is made between the discharge of sewage into a stream and the drainage of surface water from its streets.

This distinction is not an arbitrary one, but has its basis in the essential differences that obtain between the sewage, etc., on the one hand and surface drainage on the other. The rule against liability for the results of surface drainage is really based upon a necessity which obviously does not exist in the case of sewage or factory waste. The latter do not find their way into a stream naturally and necessarily in the same sense that surface water does. Often the polluting substances might be buried, burned, or otherwise disposed of, or so treated as to render them innoxious or harmless.

Thus in the case of the attorney general against the city of Grand Rapids (141 N. W. 890, 175 Mich. 503), where an injunction was sought against the continuance of the discharge of sewage into the Grand River, and also against the installation of additional sewers that would discharge into that stream, it appeared that the new sewers were to be installed for the purpose of disposing of sewage from a considerable territory, and that the practice had been to dispose of the sewage from that territory by carrying it out into the country and burying it. In that case the court also said:

> It appears in this case, and it is well known, that modern scientific research has discovered means of disinfecting and deodorizing sewage so that it is practically innocuous.

And the Michigan Supreme Court in granting an injunction permitted the defendant city to maintain the sewers, providing the sewage should be treated by means of septic tanks before being discharged into the stream.

And in the case of People ex rel. Ricks Water Co. *v.* Elk River Mill & Lumber Co. (107 Cal. 221; 40 Pac. 531; 48 Am. St. Rep. 125), decided 1895, where among other allegations it was claimed that the defendant was polluting the stream in question by discharging into it sawdust from its mill. The fact as found by the court was that the bulk of the sawdust from the mill was being burned and carefully handled, and that a very small quantity of it was allowed to escape into the river—not enough to cause any appreciable effect. Relief was denied the complainant in that case. Any number of cases might be mentioned in which the facts disclose an

alternative to the emptying of polluting matter into the stream, where such matter consists of sewage or factory waste, but these are merely cited as illustrative.

Now, on the other hand, there is no such alternative in the case of surface water. Its source is mainly the rainfall of the area which it drains, and without the intervention of any human agency it finds its way by the force of gravity into the stream. Not only is this true, but a further and most important fact is that because of the nature of its origin it does not move with an even flow, but intermittently.

The amount of annual rainfall in most localities varies greatly and never can be estimated in advance—much less can the quantity of rainfall during any given shorter period be estimated—so that whereas sewage and factory waste are both disposed of with something like an even flow, which can be estimated fairly accurately for months in advance, surface drainage is intermittent, and arrangements can not be made in advance for handling it.

In the case of the Attorney General *v.* City of Grand Rapids, as in the Winchell *v.* City of Waukesha, even the investment that would be required to install an adequate disposal plant for the city sewage was established to the satisfaction of the court.

The distinction between sewage and surface water has been abundantly recognized by the courts. In Chapman *v.* City of Rochester (110 N. Y. 273; L. A. R. 296) it was said:

> The filth of a city does not flow naturally to the lands of the plaintiff, as surface water finds its level, but is carried thither by artificial arrangements prepared by the city and for which it is responsible.

The following opinion written by Mr. Justice Holmes in the case of John Bainard *v.* City of Newton (104 Mass. 255) shows the recognition of the same distinction:

> This is a bill in equity to enjoin the city of Newton from discharging sewage into a brook called Cheese Cake Brook, above the plaintiff's land upon the brook, and from emptying more water into it than would flow into it naturally. The master's report shows that the city has constructed a system of surface drainage in some of its streets and ways under the powers relating to the public streets and ways, and that no drainage comes into the brook except what comes from the ordinary wash of these streets and ways. In one place in the watershed west of the brook the surface water gathered into a small stream for some 1,300 feet and then spread over the surface again and disappeared below the plaintiff's land. A "small but substantial" portion of the water from the western watershed, including perhaps a portion of the last-mentioned water, and water from the eastern watershed, which before had not entered the brook, now flows into it through the drains. The increase occurs mainly in heavy rains and sudden thaws, generally does not last many days, and is not found to cause the brook to overflow. The surface drainage into the brook being now from streets, the water is no longer clear, the fish have been driven from it, and at times it has a disagreeable smell, not found to amount to a nuisance.

Upon these facts we are of opinion that the bill must be dismissed. The pollution of the water by the usual impurities from streets is not a cause of action. The use of its land for streets, with the usual consequences to owners lower down upon the stream, would not exceed the common-law rights of an upper owner. (Wheeler *v.* Worcester, 10 Allen (Mass.) 591, 602; Winfield *v.* Worcester, 110 Mass. 216, 220. See Middlesex Co. *v.* McCue, 149 Mass. 103.) Equally little can the plaintiff complain of the increased discharge of surface water into the stream. We do not say that no change of the watershed on a large scale could give rise to a cause of action on the part of a lower proprietor, but a change which only slightly and occasionally enlarges the flow of a natural stream within its capacity, and does not make it overflow, is not actionable. (Jackman *v.* Arlington Mills, 137 Mass. 277, 283.) Again, so far as appears, all the damage to the plaintiff, if any, was the necessary consequence of the laying out of the streets and ways from which the surface drainage came. If so, and if the statutes impose a greater liability than the common law for this damage, when so caused (Woodbury *v.* Bromly, 153 Mass. 245) the only remedy is under the statute. (Flagg *v.* Worcester, 13 Gray, 601, 603; Wheeler *v.* Worcester, 10 Allen, 591, 603; Collins *v.* Waltham, 151 Mass. 196, 198.)

Bill dismissed.

So in Crane *v.* Village of Roselle (236 Ill. 97), decided October 1, 1908, which was a suit for an injunction to prevent the defendant village from proceeding with the construction of a drainage system, the court found there had been no convincing proof that sewage was to be emptied into the drain, and said:

It is clear that the stream in question is the natural outlet for the surface drainage of the village and vicinity. * * * The village owning the dominant heritage in this case had a right to collect its surface waters and have them pass off over the servient heritage belonging to complainant, so long as it did not cast its sewage upon his land and thereby create a nuisance, and it makes no difference whether said surface water be collected by ditches upon the surface or by tile drains underground. (Robb *v.* Village of La Grange, 158 Ill. 21.)

In another Illinois case, that of Robb *v.* Village of La Grange (158 Ill. 21, at p. 27), which was a suit to enjoin the dumping of sewage into a stream flowing through plaintiff's land, the court said:

In this State the same rule is applied to surface water flowing in a regular channel that is applied to a water course. The owner of the dominant heritage or higher tract of land has the right to have the surface water falling or coming naturally upon his premises pass off the same through the natural drains upon and over the lower or servient lands, and the owner of the dominant heritage may by ditches drain his own land into the natural channel, even if the quantity of water thrown upon the servient heritage is thereby increased. (Peck *v.* Herrington, 109 Ill. 611.) Under this rule, adopted in the case cited and in other cases in this court, the village of La Grange, being located on higher lands than the land occupied by complainant, had the undoubted right of drainage of its water in a natural channel over complainant's land into Salt Creek, and had the village confined its drains to carrying off surface water or other waters which proper drainage required in order to improve the streets and render the lots of the village more suitable for building purposes there would be no ground for complaint.

In the case of Anchor Brewing Co. *v.* Village of Dobbs Ferry (84 Hun (N. Y.), 274; 91 Sup. Ct. Rep. 274), decided February, 1895, affirmed on opinion below by court of appeals, June 24, 1898 (156 N. Y. 695), the court said:

The case shows that the increased volume of water, which in time of rainfall is now cast upon the plaintiff's property, is the result of the growth of population in the village and the consequent grading of streets, erection of buildings, and improvement of private grounds. In its natural condition much of the water that fell upon the land was absorbed by the soil and evaporated by the atmosphere, and a part only reached the foot of the watershed. But graded streets, paved gutters, and flagged walks prevent its absorption by the ground, and in increased quantities it flows in its natural course to the river.

For this result, however detrimental and injurious it may be to the plaintiff's property, we are of opinion that the defendant is not liable. It can not be compelled to construct drains for the disposal of surface water. (Mills *v.* City of Brooklyn, 32 N. Y. 489; Hines *v.* City of Lockport, 50 N. Y. 236.)

Neither can it be compelled to destroy its streets or move its gutters and paving. What the village did was lawful at the time, and in the absence of any claim that it had exceeded its power or performed the work in a negligent manner, it is not legally responsible for the consequential injury to adjacent property.

Wheeler *v.* City of Worcester (10 Allen (Mass.) 591) is a case in which the plaintiff sued for damages to his premises caused by the backing of the drain which led from his buildings to a brook, which brook flowed through the defendant city above the plaintiff's premises. It was alleged that one of the causes that contributed to the backing up of the drain was that the surface wash from the streets of Worcester had greatly increased and that large quantities of soil, etc., had been carried into the stream and filled up the bed. Upon this branch of the case the court said:

The surface wash from the streets. This is stated (in the findings of auditors to whom the case had been referred) to be incidental to the growth of the city and the construction of the streets. It finds its way naturally into Mill Brook, which furnishes the only channel for the accumulated surface water of the vicinity. No new watercourse has been diverted into it. It receives no more water than would be collected from the natural surface of the land, but, by the changed uses to which a dense population has appropriated it, the soil of the numerous streets has been carried into the stream. To hold the defendants liable to an action from such cause would be to say that the owner of land must be restricted to such uses of it as will not, by the ordinary action of the elements, cause the soil to wash in and fill to any increased extent the adjacent brooks and streams. The injury which results to the plaintiff from this cause must be regarded as damnum absque injuria. * * *

BUT WHERE A CITY ALTERS THE NATURAL COURSE OF DRAINAGE AND CAUSES MATERIAL INCREASE IN THE QUANTITY OF THE FLOW IN A GIVEN DIRECTION, AND MATERIAL INJURY RESULTS, THE CITY IS LIABLE FOR THE INJURY.

In Daley *v.* Watertown (192 Mass. 116), decided May 17, 1906, defendant city, acting under an order of the county commissioners,

widened a street known as Belmont Street, and changed the direction of the flow of surface water over a part of the land which was added to the street. For some years prior to this the city had maintained a large pipe drain connecting with an open ditch running from Belmont Street, through the land of one Joshua Coolidge, into Puffers Pond, a small pond with no outlet, and upon widening the street the city obtained from Coolidge a written license to continue the use of this drain and, if necessary, to construct a new one over his land to conduct the water to Puffers Pond. The natural drainage of the land added to Belmont Street was in another direction, into a larger pond, called Birds Pond.

Plaintiff owned a house and lot in Watertown, across a private way from Puffers Pond. The pond overflowed and submerged a large part of plaintiff's lot and filled his cellar to a depth of 3 or 4 feet with filthy water. He sued for damages. The court said:

The evidence well warranted a finding that the overflow of water from Puffers Pond caused a nuisance to the damage of the plaintiff and other property owners, and that this was chiefly due to the inflow of water through the drain and ditch which the defendant town maintained. The evidence plainly shows that the responsibility for the construction and maintenance of this drain was upon the town, through the selectmen acting as its agents, and not upon the superintendent of streets as a public officer.

The remaining question is whether the construction of the drain was in violation of private rights. The right of the town to construct the way under the order of the commissioners could give it no right to lay a drain or dig a ditch through the land of a private owner for the purpose of conducting water and discharging it there. (Franklin *v.* Fisk, 13 Allen, 211.) No one under the highway act could have an assessment of damages for the probable consequences of such a trespass, for the trespass could not be anticipated, and it would not be a natural and legitimate consequence of the laying out of the street. The only right of the town to maintain the drain in Coolidge's land was obtained through its license, but Coolidge could give the town no greater rights than he had himself. He had no right as a landowner to take surface water which naturally would drain in another direction, and which had been collected and brought to catch basins near his land, in a large quantity, and to carry it down into the pond in a stream in such quantity as to make the pond overflow and cause a nuisance to other landowners in the vicinity. The evidence tended to show a material change in the condition of the pond by discharging water into it which ought to have gone elsewhere.

It is true that cities and towns in the construction of streets, like private owners on their own lands, may deal with surface water in a reasonable way. They may erect barriers to prevent it from coming upon the street from adjacent lands. They may turn it from the streets upon abutting lands, if they do it in such a way as to cause no unreasonable damage.

In the present case there was something more than an ordinary disposition of surface water. The jury might find that there was an unnecessary and unreasonable change in the course of surface water, to which the contour of the land was not adapted, so as to bring it down in large quantities to a place from which it could not escape, and where its presence would be likely to create a nuisance.

But the mere fact that surface water has been diverted will not render a city liable to an injunction. Relief will not be given unless there is also material injury to the lower proprietor.

In Thomas *v.* City of Grinnell (153 N. W. 91), decided June 21, 1915, the plaintiff sued to enjoin the installation of a new sewer system by the defendant city and a part of the basis of the complaint was that the city proposed by the new sewers to conduct surface water from a large area into the stream, known as Sugar Creek, which flowed through the plaintiff's premises, instead of allowing the surface water from this area to flow as it naturally would and formerly did into another stream known as Little Bear Creek.

The Supreme Court of Iowa denied the plaintiff relief and said:

> * * * An examination of this record convinces us that plaintiff fails to show with any reasonable certainty that the drainage from the city which is merely an incident to the construction of a sewer system constructed for an altogether different purpose will increase the flow of Sugar Creek in a manner to materially injure the lower riparian proprietors. The preponderance of evidence given by engineers and experts who have examined the premises and computed both the probable flow and the capacity of the creek is to the effect that such increase will not swell the volume of water to an extent liable to injure adjacent lands. It is unnecessary to go into recitation of the figures and estimates given by the engineers and others. It is enough to say that the showing of anticipated injury is not so clear or certain that we can interfere in advance and place our veto upon a proposed municipal improvement which may be of great, if not vital, importance to the convenience, comfort, and health of a large community which is willing to assume the burden of its construction and maintenance and to guard its operation in a manner to prevent its becoming a nuisance to others. Men of great learning and wide experience who have familiarized themselves with the subject express the view that the incidental drainage of surface and percolating waters will not be enough to create a burden upon the plaintiff or his property. Manifestly any estimate which can be made of the amount is largely speculative and affords a very unsubstantial basis on which to nullify the act of a city acting within the scope of its express statutory authority.

And in distinguishing earlier Iowa cases, the court stated that they had held not "that the diversion of water from its natural flow upon or away from the land of another is actionable and still less that equity will always interfere to prevent such diversion," but that the city will not be permitted to divert the water "to the substantial injury of the lower proprietor," and that no technical invasion of one's premises or a merely nominal injury is sufficient ground to constitute a cause of action, and the court cited Livingston *v.* McDonald (21 Iowa 160, 89 Am. Dec. 574; Obe *v.* Pattat, 151 Iowa 723, 130 N. W. 903; and also Martin *v.* Schwertley, 155 Iowa 351, 136 N. W. 218. 40 L. R. A. (N. S.) 60).

NOR WILL A CITY BE PERMITTED TO BUILD ARTIFICIAL DRAINS AND THEREBY CONDUCT SURFACE WATER INTO A STREAM IN SUCH QUANTITIES AS TO EXCEED THE CAPACITY OF THE STREAM AND CAUSE THE SAME TO OVERFLOW TO THE INJURY OF A LOWER PROPRIETOR.

In Noonan *v.* City of Albany (79 N. Y. 470) the plaintiff sued the defendant for damages to his premises in the city of Albany, caused by water, dirt, and filth thrown and deposited thereon by defendant.

The defendant by means of the Lark Street and connecting sewers and the manner of grading Colonie Street, concentrated the surface water and sewage of a large territory and discharged it in one body at the junction of Lark and Colonie Streets into a ravine. It passed after its discharge over ground used as a dumping place for refuse, and down the declivity until it reached the valley or bed of the ravine, and flowing easterly reached the premises of the plaintiff and having no sufficient outlet, flooded the plaintiff's lot and deposited thereon the filth carried by the sewers and the sand and dirt washed down by the water as it passed over the dumping ground. This prima facie established a right of action in the plaintiff. A municipal corporation has no greater right than an individual to collect the surface water from its lands or streets into an artificial channel and discharge it upon the lands of another, nor has it any immunity from legal responsibility for creating or maintaining a nuisance.

One contention of the defendant city was "that it had a legal right to drain into a stream which flowed through the bed of the ravine across the plaintiff's land without responsibility for consequential injuries resulting to the plaintiff from such drainage, and that the water and sewage which flooded the plaintiff's land were discharged into this stream." As to this contention the court said:

The right of a riparian owner to drain the surface water on his lands into a stream which flows through them, and which is the natural outlet, is an incident to his right as riparian owner to the reasonable use of the stream. But this right is not, we conceive, an absolute right under all circumstances, irrespective of the size of the stream, or the natural purpose which it subserves, to throw into it surface water by means of ditches or drains, when by so doing it will be filled beyond its natural capacity and overflow and flood the lands of a lower proprietor. The stream into which the sewage and water collected by the defendant found its way was a mere rivulet of water, the outlet of springs at the head of the ravine. It may also, before the sewers were built or Colonie Street was graded, have received a portion of the surface water from the territory drained thereby. But at that time the surface water had no defined channel. It was subject to be disposed of by the ordinary processes of nature. Absorption and evaporation would diminish the amount which otherwise might have found its way to the valley, and the discharge into the stream of the portion not otherwise disposed of would naturally be gradual and reach it at different points in its course. It does not appear that the city owned any of the land between the sewer and the watercourse, but it had with the consent of the property owners changed the watercourse from its natural condition and constructed a box drain 2 or 3 feet square in its place. In view of the character and capacity of this watercourse, it can not, we think, be held as matter of law that there was the right in the city to discharge

into the stream the water from Colonie Street and from the Lark Street sewer, although by so doing it would flood the premises of the plaintiff. It follows that the first request to charge was properly refused. The request assumes that the city, using reasonable care, had the absolute right to drain into the watercourse in question, irrespective of the capacity of the stream or the amount of water discharged into it, and the court was requested to instruct the jury that it was not liable "for any damage caused by any increase in the amount of water thrown into the stream by such drainage."

AT COMMON LAW A CITY SEEKING TO MAINTAIN THE PURITY OF A STREAM, AS A LOWER RIPARIAN PROPRIETOR, HAS NO GREATER RIGHT THAN AN INDIVIDUAL TO LIMIT THE USE OF THE STREAM BY UPPER PROPRIETORS.

Such was the holding of the Michigan Supreme Court in the case of People *v.* Hulbert (131 Mich. 156, 64 L. R. A. 265). In that case, the city of Battle Creek, for the purpose of obtaining a water supply, purchased a piece of land along the shore of Goguac Lake, which was situated near the city, and most of the shore of which was occupied by farmers, pleasure-resort proprietors, and summer cottages. The respondent had occupied a cottage on the shore for several summers and had been in the habit of bathing in the lake.

After the purchase of the shore property by the city and the installation of a pumping station to pump water for its water supply, the city, for the purpose of making a test case, had the respondent arrested for swimming in the lake. No statute is mentioned in the opinion as having been violated. Apparently the case against respondent was upon the theory that because the city had commenced to utilize the Goguac Lake as a water supply it thereby became a nuisance to swim in the lake. While there was expert testimony to the effect that germs might be thrown off from the body of respondent while swimming and might reach those consuming the water and result in ill health, there was no claim that any such result had in fact occurred.

The opinion of the court expressly states that the city of Battle Creek had under its charter "ample power to condemn lands and easements for a water supply upon paying due compensation for the rights taken."

The court said:

The first question calling for consideration is: Was the act of respondent unlawful? It is a matter of common knowledge that in this State the riparian owners whose lands border upon lakes and through whose lands streams run are in the habit of using the streams and lakes by allowing their domestic animals to drink therein and by drawing therefrom what water may be needed for domestic purposes; and themselves and their families resort to the water of the streams and lakes for the purpose of bathing at suitable seasons of the year. It is also known that, as a rule, the supply of cooking and drinking water is obtained from springs or wells. Will the fact that a lower

riparian proprietor decides to use the water of the stream or lake for drinking and cooking purposes make a reasonable use of the water by the upper riparian owners for the purposes of watering cattle and bathing purposes unlawful, because to do so has a tendency to make the water less desirable for drinking and cooking purposes? Can the upper proprietors be deprived of such reasonable and ordinary use when the lower proprietor is a city having a large population by invoking the police power, and without compensation? It will readily be seen these are very important questions. The diligence of able counsel has failed to call our attention to a case on all fours with the one at bar, but the principles involved are not new.

Copious quotations are then made from a number of cases in which the general principles relating to pollution of waters are laid down. The opinion then proceeds:

It is very clear from these cases that the lower proprietor has no superior right to the upper one, and may not say to him that, because the lower proprietor wants to use the water for drinking purposes only, the upper proprietor may not use the water for any other purpose. Each proprietor has an equal right to the use of the stream for the ordinary purposes of the house and farm, even though such use may in some degree lessen the volume of the stream or affect the purity of the water. (Hazeltine *v.* Case, 46 Wis. 391, 32 Am. Rep. 715, 1 N. W. 66; Ulbricht *v.* Eufaula Water Co., 86 Ala. 587, 4 L. R. A. 572, 11 Am. St. Rep. 72, 6 So. 78; Lewis Em. Dom., sec. 65.) This right is not affected by the fact that the lower proprietor is a municipality instead of an individual. (Smith *v.* Rochester, 92 N. Y. 463, 44 Am. Rep. 393; Haupt's Appeal, 125 Pa. 211, 3 L. R. A. 536, 17 Atl. 436.) It is not believed a case can be found where, out of deference to the rights of the lower riparian proprietor, it is made unlawful for the upper proprietor to make such reasonable and ordinary use of the water passing over his land as was made by the respondent in this case.

It is insisted by the people that under police power, it was competent to forbid any act on the part of the upper proprietor that would tend to impair the public health. It may be conceded that the police power of the State is very broad, but our attention has not been called to any principle of law or to any case the practical application of which will enable a village, city, or other municipality, for the purpose of obtaining a water supply, to prevent the ordinary and reasonable use of the waters of an inland lake or stream by an upper riparian proprietor, without the exercise of the right of eminent domain or without compensation.

In what we have said we do not mean to intimate that an upper proprietor may convert his property into a summer resort and invite large numbers of people to his premises for the purposes of bathing, and give them the right possessed only by the riparian owner and his family. We are undertaking to decide only the case which is presented here. Upon the record as made, we think the court should have directed a verdict in favor of respondent.

The conviction is reversed and a new trial ordered.

It would appear that the view of the Michigan Supreme Court was that what the city was really seeking to accomplish was the acquisition of a property right and that this could only be acquired by it by the exercise of its power to eminent domain.

In the case of Helfrich *v.* Catonsville Water Co. (74 Md. 269; 13 L. R. A. 109), an action was brought by a private water company to enjoin the defendant, Helfrich, from permitting his cattle to have access to a stream above the plaintiff's source of supply.

The Maryland Supreme Court, in denying the relief upon the ground that Helfrich was only making a reasonable use of the stream, pointed out:

> The water company has power, under its charter, to acquire the water right by making due compensation to the owner, and not otherwise.

While the complainant in this case was not a municipality, it would seem that the same rule should be applied and that if it is proper to require compensation to be made for taking of property rights by water company, there can be no sound reason why a municipality ought not to be required to make similar compensation.

What is here said, of course, relates only to the rights of municipalities at common law. The right of the State to confer additional authority upon municipalities will be discussed later.

II. DIGEST OF JUDICIAL DECISIONS RELATING TO STATUTES.

INTRODUCTION.

The rights and remedies which have been considered thus far are only those given by the common law.

Riparian rights have, however, been altered in varying degrees by statutes enacted in the several States, and within recent years there has been a great deal of activity in many of the States in enacting laws affecting stream pollution. A number of causes have operated to bring to the attention of the various States the importance to the public of the best use being made of the stream. On the one hand, the vast increase of population, particularly in urban centers, has brought with it the problem of disposing of the greatly increased quantity of sewage. On the other hand, the tendency of the increased quantity of sewage and the increased quantity of factory waste to pollute the streams to such a degree as to destroy fish life, to render the water unfit for domestic use and to greatly curtail the quantity of available water for the public, has required that some limitation be placed upon the character and quantity of sewage and waste permitted to enter the streams.

Again the science of medicine has, within recent years, disclosed dangers to the public from the use of polluted waters, which were before unknown.

On the other hand, the purification and rendering innocuous of both sewage and factory wastes have received a vast amount of investigation and research by eminent scientists within recent years, and it has been found practicable to prevent at least a very large part of the injury to streams which had previously been considered inevitable.

It will be seen then that the State has, like the individual riparian proprietor, a dual interest in the stream, or rather the duty of protecting a dual interest of the public. On the one hand, the sewage and drainage of cities must be disposed of for the protection of the health of the community and the logical and convenient outlets are the streams. On the other hand, and also from the standpoint of health, the public water supplies must be protected and nuisances prevented.

The question naturally arises as to whether a State has the power to enact such legislation as it pleases controlling the waters within its borders. It is apparent that the dual interest of the public must inevitably lead the State to enact legislation along two different and somewhat conflicting lines, and it will be found that the power of the State is more limited in the one kind of legislation than in the other.

TO PROTECT ITS STREAMS AGAINST POLLUTION, A STATE MAY, WITHOUT PROVIDING COMPENSATION, CURTAIL THE RIGHTS OF THE RIPARIAN OWNER IN HIS USE OF THE STREAM, ACCORDING TO THE WEIGHT OF AUTHORITY.

In the case of State against Griffin (69 N. H. 1), a State statute had been passed which prohibited the depositing of sawdust in the tributaries of Massabesic Lake, which lake was the source of a water supply of the city of Manchester. The defendant was a lessee of property on Sucker Brook, a tributary of the lake. There was a sawmill on the property, and the defendant discharged sawdust into the brook therefrom, which had the effect of imparting a woody taste to the water and to discolor it and to render it unwholesome near the mill. Other sawmills discharged sawdust into the same stream, and near the mills the water was unwholesome; but at the point where the city's supply was taken from the lake the effect of the sawdust could not be detected except by chemical analysis.

The defendant contended that the act was unconstitutional because it deprived him of his property without compensation.

The Supreme Court of New Hampshire held that the statute did not involve a taking of the property of the defendant without compensation, but that it was a valid exercise of the police power of the State. The court quoted at great length from the case of Commonwealth *v.* Alger (7 Cush. 53, 84–86) as to the nature and extent of the police power of the State. A part of that language is as follows:

> * * * All property in this Commonwealth is derived directly or indirectly from the Government and held subject to those general regulations which are necessary to the common good and general welfare. Rights of property, like all other social and conventional rights, are subject to such reasonable limitations in their enjoyment as shall prevent them from being injurious, and to such reasonable restraints and regulations established by law as the legislature, under the governing and controlling power vested in them by the constitution, may think necessary and expedient. This is very different from the right of eminent domain—the right of a government to take and appropriate private property to public use whenever the public exigency requires it, which can be done only on condition of providing a reasonable compensation therefor. The power we allude to is rather the police power—the power vested in the legislature by the constitution to make, ordain, and establish all manner of wholesome and reasonable laws, statutes, and ordinances, either with penalties or

without, not repugnant to the constitution, as they shall judge to be for the good and welfare of the Commonwealth and of the subjects of the same. It is much easier to perceive and realize the existence and sources of this power than to mark its boundaries or prescribe limits to its exercise. There are many cases in which such a power is exercised by all well-ordered governments and where its fitness is so obvious that all well-regulated minds will regard it as reasonable. Such are the laws to prohibit the use of warehouses for the storage of gunpowder near habitations or highways; to restrain the height to which wooden buildings may be erected in populous neighborhoods, and require them to be covered with slate and other incombustible material; to prohibit buildings from being used for hospitals for contagious diseases or for carrying on of noxious or offensive trades; to prohibit the raising of a dam and causing stagnant water to spread over meadows near inhabited villages, thereby raising noxious exhalations injurious to health and dangerous to life. Nor does the prohibition of the noxious use of property—a prohibition imposed because such use would be injurious to the public—although it may diminish the profits of the owner, make it an appropriation to a public use so as to entitle the owner to compensation. If the owner of a vacant lot in the midst of a city could erect thereon a great wooden building and cover it with shingles, he might obtain a larger profit of his land than if obliged to build with stone or brick with a slated roof. If the owner of a warehouse in a cluster of other buildings could store quantities of gunpowder in it for himself and others, he might be saved the great expense of transportation. If a landlord could let his building for a smallpox hospital or a slaughterhouse, he might obtain an increased rent. But he is restrained—not because the public may have occasion to make the like use or to make any use from it, but because it would be a noxious use, contrary to the maxim, Sic utere tuo ut alienum non laedas. It is not an appropriation of the property to a public use but the restraint of an injurious private use by the owner, and is therefore not within the principle of property taken under the right of eminent domain.

And the New Hampshire Supreme Court said:

The universal doctrine on the subject is nowhere more clearly stated than in the foregoing language of Chief Justice Shaw.

In the case of Henry H. Sprague and others *v.* James Dorr (185 Mass. 10), decided January 7, 1904, the Massachusetts Supreme Court, speaking of the right to make "rules and regulations for the sanitary protection of all waters used by the metropolitan water board for the water supply of any city, town, or water company," etc., said:

* * * That the exercise of such authority by the legislature is within the police power as it is generally defined by the courts, and within the particular provisions of chapter 1, section 1, article 4, of the constitution of Massachusetts, is too plain for discussion. It may involve a regulation and modification of a use of streams which otherwise might be made under the common-law rights of riparian proprietors. These rights include every reasonable kind of use of the water as it passes by, having a proper regard for the rights of other proprietors on the stream below. It has often been said that riparian proprietors have no right to pollute the waters of a stream. In thinly settled and remote regions, upon streams whose waters are not appropriated to domestic use, impurities may sometimes be discharged into the water without interfering with any use of it that riparian proprietors desire to make; but when the

water is to be used for drinking, as the waters of most streams may be used and of many streams are in fact used, the uses of riparian proprietors must be limited with a strict regard to cleanliness and sanitation. Hence statutes special and general have been passed from time to time, touching this subject. (St. 1878, c. 183; R. L., c. 75, sec. 124.) These laws, so far as they merely prevent the discharge into streams of polluting matter of such kind and amount as will corrupt or impair the quality of the water, are a reasonable regulation of the exercise of private rights of property in reference to the common good, and they are not an interference with property that calls for compensation to the owners.

In Lewis *v.* Stein (16 Ala. 24) a statute provided that any person obstructing or injuring the waters of Threemile Creek by rocks, logs, or other materials between its source and the place where the water was taken for the use of the city of Mobile should forfeit the sum of $20, to be proven by an action of debt. Proceedings against the defendant were had under the statute upon the ground that defendant was injuring the waters through his operation of a sawmill. A statute was passed a short time after the mill was erected, but the action was not begun until some 30 years thereafter.

While a physician testified that the sawdust would not render the water less healthful, the court found that the existence of such a substance in the water was injurious to it.

To say the least (said the court) it renders the water less pure and is calculated to annoy and disgust those who have to use it for the ordinary purposes of life, and consequently must be an injury to it.

The defendant contended that the effect of the proceeding would be to deprive him of his property for the public good without compensation, because he would have to abandon the use of his mill if he were not permitted to discharge sawdust into the stream, but the court held that while he had a right as a riparian proprietor to use the water, he had no right "to abuse it to the injury of another. By his acts he not only used it, but, as the evidence shows, injured others."

So in State *v.* Wheeler (44 N. J. L. 88) the court upheld the constitutionality of an act entitled "An act to prevent the willful pollution of the waters of any of the creeks, ponds, or brooks of the State." The defendant had been convicted, and contended that unless the act were so construed as to apply only to acts calculated to render water, as supplied to reservoirs, impure or offensive, it would deprive an owner of property of its use without compensation and so be unconstitutional. The court said:

The whole act plainly shows a design to protect from pollution the waters of creeks, etc., used as the feeders of reservoirs for public use, without any reference to whether such pollution in fact appreciably affects the water when arrived at the reservoir.

Nor does such a construction render this act objectionable. The design of the act is not to take property for public use, nor does it do so within the meaning of the Constitution. It is intended to restrain and regulate the use of private property so as to protect the common right of all the citizens of the State. Such acts are plainly within the police power of the legislature, which power is the mere application to the whole community of the maxim "Sic utere tuo, ut alienum non laedas." Nor does such a restraint, although it may interfere with the profitable use of property by its owner, make it an appropriation to a public use so as to entitle him to compensation. (Citing Comm. *v.* Alger, 9 Cush. 53; Comm. *v.* Tewksbury, 11 Metc. 55, and other cases.) * * *

Nor is there anything to render such legislation objectionable because in some instances it may restrain the profitable use of private property where such use in fact does not directly injure the public in comfort and health; for to limit such legislation to cases where actual injury has occurred would be to deprive it of its most effective force. Its design is preventive, and to be effective it must be able to restrain acts which tend to produce public injury. Many instances of the exercise of such power may be found [citing instances] * * *. The object of this legislation is to protect the public comfort and health. For that purpose the legislature may restrain any use of private property which tends to the injury of those public interests. That the pollution of the courses of the public water supply does so tend no one can deny.

So in the case of City of Durham *v.* Eno Cotton Mills (141 N. C. 615, 54 S. E. 453, 7 L. R. A. (N. S.) 321) a statute forbade any person or municipality to "discharge sewage into any drain, brook, creek, or river from which a public drinking-water supply is taken," unless subjected to a purification process, approved by the board of health, and providing that such discharge might be enjoined. The defendant company was sued by the city of Durham and the water company for an injunction to prevent the discharge by the defendant of sewage from its mill into the river at a point some 17 miles above the intake of the water company. The defendant contended that the act was unconstitutional and void and that its enforcement in the present instance would involve the taking of its property without compensation and would amount to confiscation. But the court said:

It will be observed by reading the act that it is not required that the sewage discharged into the stream should injuriously affect the water at the intake; it is quite sufficient if it pollutes the river at the sewer's outlet. The legislature has decided that it is desirable to preserve our natural streams in at least their present state of purity, and where they have been polluted to remove the cause as speedily and effectually as possible. It has therefore said that no person shall deteriorate the water at all by sending sewage into a natural stream until it has been purified and made wholesome, or until all the noxious matter in it has been eliminated. All this means, of course, that the water shall not be poisoned by sewage at the outfall. We must assume that the defilement of the water is an injury which is forbidden by the legislature for perfectly good and sufficient reasons. It is not for us to question the policy or expediency of such an enactment. In this respect the legislature has a large discretion, to be exercised in such way as will, in its judgment, promote the interests and advance the welfare of the people, and it has this discretion to such an extent

as to be virtually a law unto itself so far as the manner of its exercise is concerned. Such legislation is not intended merely to abate an existing nuisance, but to prevent that being done which is a menace to the public health, and which it is supposed may become a deadly peril and a public nuisance because fatal in its consequences. It is not, therefore, a void law because it is founded upon a mere apprehension of evil, but is a precautionary measure which is clearly within the police power of the State and to be adopted when deemed necessary to secure the public health.

And in the recent case of Ohio State Board of Health et al. *v.* The City of Greenville et al. (Ohio St. 1, 98 N. E. 1019; Ann. Cas. 1913 D, p. 52), in discussing the validity of the statute relating to the purification of sewage discharged into streams, etc., the court said:

* * * This particular legislation now under consideration is designed to preserve and protect the public health and comfort, and therefore falls directly within the police power of the State. This power includes anything which is reasonable and necessary to secure the peace, safety, health, morals, and best interests of the public. It is now the settled law that the legislature of the State possesses plenary power to deal with these subjects so long as it does not contravene the Constitution of the United States or infringe upon any right granted or secured thereby, or is not in direct conflict with any of the provisions of the constitution of this State, and is not exercised in such an arbitrary and oppressive manner as to justify the interference of the courts to prevent wrong and oppression. The right of a court to interfere with the legislature of a State in the exercise of police power is very clearly expressed by Mr. Justice Harlan in the case of Jacobson *v.* Massachusetts (197 U. S. 11): "If there is any such power in the judiciary to review legislative action in respect of a matter affecting the general welfare, it can only be when that which the legislature has done comes within the rule that if a statute purporting to have been enacted to protect the public health, the public morals, or the public safety has no real or substantial relation to those objects, or is beyond all question a plain, palpable invasion of rights secured by the fundamental law; it is the duty of the courts to so adjudge, and thereby give effect to the Constitution." This doctrine has also been declared in the case of Mugler *v.* Kansas (123 U. S. 623; Minnesota *v.* Barber, 136 U. S. 313, 320; Atkin *v.* Kansas, 191 U. S. 207, 223. The possession and enjoyment of all rights guaranteed to the citizen under the Constitutions of the United States and the State of Ohio are subject to such reasonable conditions as may be deemed by the governing authority of the State essential to the safety, health, peace, good order, and morals of the community. It is said by Mr. Justice Field in the case of Crowley *v.* Christensen (137 U. S. 86) that "Even liberty itself, the greatest of all rights, is not unrestricted license to act according to one's will. It is only freedom from restraint under conditions essential to the equal enjoyment of the same right by others." In the case of Holden *v.* Hardy (169 U. S. 366) it was held that "It is as much for the interest of the State that the public health should be preserved as that life should be made secure. With this end in view quarantine laws have been enacted in most, if not all, of the States; insane asylums, public hospitals and institutions for the care and education of the blind established, and special measures taken for the exclusion of infected cattle, rags, and decayed fruit. In other States laws have been enacted limiting the hours during which women and children shall be employed in factories, and while their constitutionality, at least as applied to women, has been doubted in some of the States, they have been generally upheld."

In this State the authority of the general assembly to exercise the police power of the State is no longer an open question. It has been settled by numerous adjudications that such power may be exercised by the general assembly of the State according to their judgment and discretion in any manner not inconsistent with or repugnant to provisions of the State or Federal Constitutions. (Commissioners of Champaign County *v.* Church, administrator, 62 Ohio St. 344; Cincinnati, Sandusky & Cleveland Rd. Co. *v.* Cook, 37 Ohio St. 265; C., H. & D. Rd. Co. *v.* Sullivan, 32 Ohio St. 152; L., S. & M. S. Ry. Co. *v.* C., S. & C. Ry. Co., 30 Ohio St. 604; C., H. & D. Ry. Co. *v.* City of Troy, 68 Ohio St. 510.)

It is true that the mere assertion by the legislature that a statute relates to the public health, safety, or welfare does not bring that statute within the police power of a State. It must appear from the statute itself that its real intent and purpose is the conservation and preservation of public health, public safety, or public morals, and when this fully and clearly appears, then the doctrine announced in the case of Jacobson *v.* Massachusetts (supra) applies, and a court will then only inquire whether such legislation is "beyond all question a plain palpable invasion of rights secured by the fundamental law." The legislation we are considering admits of no doubt as to the purposes to be subserved thereby. It is clearly an effort on the part of the legislature of the State to preserve and protect the public health and comfort, and the only remaining question for this court is, whether it clearly appears that this legislation is in conflict with organic law. * * *

And in a very important case in Maryland, Welch *v.* Coglan (126 Md. 1), decided April 14, 1915, in which a statute relating to sewage disposal was construed, the court said:

* * * The basis for all legislation of this character is to be found in the police power of the State. While no precise boundaries have ever been set as to what may and what may not be properly classed as an exercise of police power, the protection and preservation of the public health has universally been recognized as one of the primary fields for its exercise, and it needs no citation of authorities for the proposition that in a city or thickly populated community nothing is more vital to the preservation and protection of the public health than the establishment of proper and suitable drainage and sewerage.

In Boehm *v.* Baltimore (61 Md. 363) Judge Miller, speaking for this court, said: "The preservation of the health and safety of the inhabitants is one of the chief purposes of local government."

The same doctrine was even more explicitly stated by the late Judge McSherry, in the case of State *v.* Hyman (98 Md. 613), as follows:

"One of the legitimate and most important functions of civil government is acknowledged to be that of providing for the welfare of the people by making and enforcing laws to promote and preserve the public health, the public morals, and the public safety. Civil society can not exist without such laws, and they are therefore justified by necessity and sanctioned by the right of self-preservation. The power to enact and enforce them is lodged by the people with the government of the State, qualified only by such conditions as to the manner of its exercise as are necessary to secure the individual citizen from unjust and arbitrary interference." And to the same effect was the decision in Deems *v.* Baltimore (80 Md. 173; Sprigg *v.* Garrett Park, 89 Md. 499; and State *v.* Broadbelt, 89 Md. 565).

And the legislative authority to control stream pollution under the police power is similarly upheld in the following cases:

Miles City *v.* Board of Health, 39 Mont. 405; 102 Pac. 696; 25 L. R. A. (N. S.) 589; decided 1909.
State Board of Health *v.* Diamond Mills Paper Co. 63 N. J. Eq. 111; Aff. 64 N. J. Eq. 745.
Brookline *v.* Mackintosh, 133 Mass. 215.
State *v.* Morse, 84 Vt. 387; Ann. Cas. 1913 B, p. 218; decided May 8, 1911.
Commonwealth *v.* Sisson, 189 Mass., 247, decided 1905.
Nelson *v.* State Board of Health, 186 Mass., 330, decided 1904.
Lewis *v.* Stein, 16 Ala. 24.
Salt Lake City *v.* Young, 45 Utah, 349, 145 Pac. 1047.

This recognition of the authority to curtail riparian rights under the police power is not quite universal, and the courts of a few of the States have held, or strongly intimated, that such detailment amounts to a taking of property or property rights, which the constitutions of each of the States only permit upon payment of compensation.

For example, in People *v.* Hulbert (151 Mich. 156, 64 L. R. A. 265) it does not appear that any statute was relied upon and hence the extent of the power to enact such legislation was not directly involved. Respondent had been convicted of bathing in a lake which the city of Battle Creek had recently commenced to utilize as a source of water supply, the city having become a lower-riparian owner on the lake. The theory of the prosecution appears to have been that the mere fact that the water of the lake was being utilized for a water supply operated to constitute bathing in the lake a nuisance. The Michigan Supreme Court repudiated this theory and held the conviction invalid. In the course of the opinion, in discussing the police power of the State generally, the court made use of the language which is susceptible of a construction that would deny the right even by legislation to restrict the common-law riparian rights of the respondent without compensation.

Indeed, the Michigan case has been so construed by the Supreme Court of Vermont, although that court refused to follow what it considered the Michigan holding, but followed the weight of authority in holding such legislation valid without compensation.

State *v.* Morse, 84 Vt. 387, 80 Atl. 189; Ann. Cas. 1913 B. p. 218.

And the Maryland Supreme Court has likewise given expression to the view that legislation of this character must provide compensation to one whose riparian rights are restricted. In the case of Helfrich *v.* Catonsville Water Co. (74 Md. 269, 13 L. R. A. 109) the water company had sought an injunction against Helfrich, not relying upon any statute but upon the theory that the mere fact that the company had commenced to utilize a stream for the purpose of obtaining a public water supply was of itself sufficient to render illegal the watering of

his cattle in the stream by Helfrich, an upper proprietor. The Maryland Supreme Court not only denied this contention, but went beyond what was actually involved and necessary to a decision of the case and said that the riparian rights of Helfrich could not be taken from him even by legislation, except upon paying of compensation.

His right was not in any way abridged by the incorporation of the water company and the establishment of its works. And it was not in the power of the legislature to abridge it. It is a right of property protected by the declaration of rights. The water company has power under its charter to acquire the water right by making due compensation to the owner, but not otherwise.

There appears to be a reluctance upon the part of the Court of Appeals of New York to meet squarely the question of the validity and the scope of the statute of that State for the preservation of water supplies. In case of City of New York *v.* Blum (208 N. Y. 237), the defendant, Blum, was the owner of a pond upon which he allowed a large flock of ducks to swim. This pond had an outlet from which the water of this pond flowed into other waters from which the water supply of the city of Brooklyn was taken.

Acting under the New York statute, rules and regulations were established by the State board of health for the protection of this supply. The city of New York contended and the lower courts held that the defendant was violating these rules and regulations and granted an injunction upon that ground. When the case reached the court of appeals, the granting of the injunction was sustained, but that court expressly declined to rest its decision upon the ground of the violation of the rules of the board of health. It was there held that the defendant, Blum, was not making an unreasonable and excessive use of the pond and should be enjoined upon common-law principles.

While, as has been seen, the weight of authority recognizes the right of the State to restrict riparian rights by legislation even without compensation for the protection of water supplies, yet it by no means follows that riparian rights are affected by the mere establishment of the water supply without legislation.

In other words, the riparian owner's right to make a reasonable use of the stream continues until restricted by specific legislation. The fact that a municipality or water company engaged in supplying water to the public commences to use the stream, the purpose of the water supply can not in and of itself affect the riparian owner's right to make a reasonable use of the stream. Such was the holding in the case of State *v.* Hulbert (supra) and Helfrich *v.* Catonsville Water Co. (supra), and it is not believed that the soundness of these decisions has ever been challenged.

It should, of course, be borne in mind that even if the right of a State to restrict the rights of the riparian owner under the police

power and without compensation should be denied, there would still remain the power of the State to limit those rights to any extent deemed expedient under the power of eminent domain. The right to take either tangible property or riparian rights under this power has never been challenged, but compensation must be made when the legislature acts under the power of eminent domain, which need not be made where the police power is held to furnish authority.

From an ethical point of view much might be said in favor of giving compensation to riparian proprietors. Frequently the effect of limiting the riparian owner's right to the use of a stream is to inflict upon him a real and substantial property loss. This may be the result even when the riparian owner has acted in perfect good faith and in accordance with good citizenship. Take the case of the discharge of sawdust into a stream. Such discharge seldom or never occurs except as an incident to useful lumbering operations. Such a discharge may be commenced at a time when no harm could result and may only become harmful when the water lower down the stream is sought to be utilized for a water supply. It may be entirely proper and necessary so to utilize the stream, but is it either proper or necessary to deprive the sawmill owner of his right to make use of the stream without compensating him for the loss he will sustain?

The State of Connecticut has taken the view that where riparian rights are taken away for the purpose of protecting the water supply the riparian proprietor must be compensated therefor. The Connecticut statute, chapter 137 of the acts of 1909, provides, in section 5, that when any land or building is so used as to pollute the waters from which ice is procured, or a reservoir used for supplying the residents of a city, town, or borough, or any source of supply of such reservoir, is liable to pollution in consequence of the use made of the land or building that application may be made by the authorities of the city, town, or borough, or the corporation having charge of the reservoir, etc., to the superior court in the county where the reservoir or water is located and that the court may make such order as is necessary to preserve the purity of the water or the ice, but the statute contains this further provision, section 6:

> Whenever any order is made by the superior court for the abatement of any nuisance to such water or ice and said court shall find that compliance with said order will damage any person or corporation or deprive him or it of any substantial right said court may assess just damages in favor of such person or corporation, to be paid by such municipality, person, or corporation as the court may decree.

In a comparatively recent case the Supreme Court of Connecticut has had occasion to construe this statute and has held that even where the use made of the premises was commenced by the riparian pro-

prietor after full notice to him that the water was being utilized as a water supply, and that if he should make such use of his premises he would be enjoined. In construing this section, the court said:

* * * We think * * * that section 6 of the act of 1909 was intended to provide for the assessment of damages in cases like this, where the thing complained of as a nuisance or as dangerous to the public health would not be objectionable except for its proximity to a source of water supply.

The history of this legislation shows that the general assembly, while giving full protection to sources of water supply, has always made some provision for possible compensation to the injured landowner, and has never acceded to the plaintiff's broad claim that danger to the public health was of itself a sufficient ground for an injunction without compensation. The original legislation on this subject was chapter 27 of 1883, which was limited to cases of actual "injury to the water," and authorized the superior court to make any orders necessary to preserve its purity. The act then provided that, "where the law requires compensation to be made," the court should appoint three disinterested freeholders, who should determine and award the compensation to be paid before the order was carried into effect. The general assembly thus recognized at the beginning of this legislation that modern theories of sanitation might require the court to issue injunctions for which compensation was required by law, although the order was necessary to preserve the purity of a public water supply. In the revision of 1902, the right to injunctive relief was extended to cases where "such water is liable to pollution," and the recognition of a possible right to compensation takes the form of a direct grant (sec. 2600) of power to "take such lands or rights" as the superior court might deem necessary for the purpose of preserving the purity of the water supply; coupled with the same provision for compensation (sec. 2601) as in the act of 1883. In 1903 (Pub. acts 1903, c. 192) the act, which up to that time had been restricted to reservoirs, was extended to any source of supply for such reservoirs, and the powers given to the superior court extended to any judge thereof in vacation. By the present act, ice pounds are protected as well as sources of water supply, and the superior court is given power, when any order is made for the abatement of any nuisance to water or ice, to assess just damages. Sections 2600 and 2601 remain in force, and the result is that there are now two methods of compensating an injured landowner; one under section 2601 by the appointment and award of a committee of freeholders, and the other by the superior court. The former applies to cases when an application is made for the taking of lands or rights therein which are deemed necessary for the purity of the water supply, and is limited to cases where "the law requires compensation to be made." The latter extends to cases where the abatement of a "nuisance to such water or ice" damages the landowner or deprives him of any substantial right, in which case the court "may assess just damages."

We think the phrase "nuisance to such water or ice" aptly describes a condition which is objectionable only or chiefly because of its effect or potential effect on such water or ice, and that section 6 authorizes the assessment of just damages to a landowner who is damaged or deprived of a substantial right by the abatement of such a nuisance.

The next question is whether the damages awarded in this case are "just damages," and the plaintiff's claim on that point is that the defendants have no right to compensation because they went into the business after full notice and with the knowledge that the plaintiff would seek an injunction. It is pointed out that one who avails himself of the proximity of the water supply to establish a new business which would be impossible except for such

proximity, and after notice that it will create a nuisance, stands in a very different equitable position from one who has long carried on a lawful business which afterwards, in the light of better knowledge of sanitation, comes to be regarded as dangerous to the public health. That is quite true, and it must doubtless have had its effect on the amount of damages awarded in this case. On the other hand, it can not be so that the plaintiff by maintaining a public water supply, and by very properly giving notice of its intention to protect it, can acquire any legal rights in adjoining lands. If these defendants have been lawfully deprived of the right of carrying on a public pleasure resort and picnic ground on their land, it must be because their property has been pro tanto taken for a public use, and for that taking they are entitled to just compensation under the statute. The plaintiff's property right in having its water supply kept free from pollution is merely an incident of the public use to which its property is dedicated, and must be exercised in accordance with the Constitution and the statutes. We are not called upon to determine whether the State might in the exercise of its police power have forbidden the defendants to make any use of the reservoir for boating, for it has not attempted to do so * * *.

Aside from the fact that the policy of providing compensation to riparian proprietors, whose rights are restricted, removes all possible doubt of the validity of the legislation, such policy would seem to be the generous and proper one for the State to assume. In other words, it would seem that the State can hardly afford to be put in the position of having done anything that would approach the confiscation of property or property rights.

The fact that the Legislature of Massachusetts modified its law prohibiting the discharge of sawdust into a stream as a result of the case of Commonwealth *v.* Sisson, previously mentioned, would seem to indicate that drastic legislation curtailing common law riparian rights without compensation tends to create a strong protest. While it is true that the legislation of that State prohibiting the pollution of streams to the detriment of water supply has not been similarly amended, yet it is hardly probable that there is the same unanimity of approval of that legislation in the State as would be likely to obtain if the act had provided compensation to the riparian proprietor.

EVEN THOUGH A RIPARIAN OWNER MAY HAVE ACQUIRED A RIGHT BY PRESCRIPTION AS AGANST LOWER PROPRIETORS ON THE STREAM TO POLLUTE THE SAME, HE IS NEVERTHELESS AMENABLE TO LEGISLATION ENACTED UNDER THE POLICE POWER FOR THE PRESERVATION OF THE PURITY OF THE STREAM AND CAN NOT CLAIM COMPENSATION UNLESS THE SAME IS PROVIDED IN THE LEGISLATION.

In the case of Sprague *v.* Dorr (185 Mass. 10), decided January 7, 1904, the Massachusetts court used dictum which cast some doubt upon this question. The court said:

* * * Whether in the exercise of the police power for the preservation of the public health, the legislature, without providing compensation, might forbid the pollution of water by one who has acquired a prescriptive right to pollute it as against other proprietors, we need not decide.

And this case, singularly enough, has been cited as an authority for the proposition that prescriptive rights can not be interfered with under the police power, but only under the power of eminent domain and upon providing compensation.

Thus in a note on the "validity of the statute or ordinance regulating the methods" (Ann. Cas. 1913 D, p. 62), it is said:

A riparian owner whose use of the stream is thus restricted (by State legislation) is without remedy unless he has acquired the right to pollute the stream by prescription, in which case his right so to do may be taken away, but he has, in return, a right to damages. (Sprague *v.* Dorr, 185 Mass. 10.)

But such doubt as may have been cast by the above dictum upon the right of the State to enact legislation under the police power in contravention of prescription appears to have been set at rest in the Massachusetts case of Commonwealth *v.* Sisson (189 Mass. 247), decided October 17, 1905. That case was one in which a statute relating to the discharge of sawdust into the streams containing fish was upheld by the court. The opinion contains the following language:

* * * The right to run a sawmill on the bank of a brook or river is, like all rights of property, subject to be regulated by the legislature when the unrestrained exercise of it conflicts with other rights, public or private. (See Commonwealth *v.* Alger, 7 Cush. 53, 54; Rideout *v.* Knox, 148 Mass. 368.) The defendants' contention that they have a prescriptive right to discharge sawdust into the river (even if it kills or injures the fish therein), which prescriptive right can not be taken away or impaired without compensation being made therefor, means this and nothing more: Where the legislature, up to the passage of the act here in question (St. 1890, c. 129) had not regulated the business of sawing wood on the banks of streams having in them edible fish, and where, in the absence of such regulation, the defendants had discharged sawdust into the stream for 30 years, the people have lost the power to regulate the conflicting rights of sawmills on the bank of the stream and to preserve fish in the stream itself. The statement of the proposition is enough to show that there is nothing in it. * * *

In the case of Miles City *v.* State Board of Health (39 Mont. 405), decided July 3, 1909, the defendant city sought the annulment of an order issued by the State board of health and prohibiting the city from emptying sewage into Yellowstone River. Among the contentions of the city was that it had acquired a right by prescription.

The court said:

* * * It is further contended that the city of Miles City has acquired by prescription the right to discharge its sewage into the Yellowstone River. The seriousness with which counsel for the city have urged this impels us to give it attention. The cases cited in their brief, however, do not sustain them. Those cases refer to rights acquired as against private individuals; but when the city asserts that it has acquired such prescriptive right as against the State, and that it is a right of such character as that against it the police power of the State can not be invoked, it assumes an altogether unique position. In the first place, a city is but one of the governmental agencies of the State, and as

such agent it could not acquire the right by prescription; for the elements of adverseness, exclusiveness, and claim of right are absent during the entire period of the city's use of the river, and those elements are essential to the establishment of a right by prescription. (Talbott *v.* Butte City Water Co., 29 Mont. 17; 73 Pac. 1111.) Furthermore, the right which the State is attempting to assert through the agency of the State board of health is a public right—a right to protect the health of the people of the State—and as against such public right prescription does not run. (Commonwealth *v.* Moorehead, 118 Pa. 344; 4 Am. St. Rep. 599; 12 Atl. 424; 22 Am. and Eng. Ency. of Law, 2d ed., 1190.) There is yet another reason why the city can not acquire such a right by prescription as that against it the State may not invoke its police power. It is now generally conceded that the police power is such a power, inherent in the State for the protection of the public, that the State may not waive or divest itself of the power to exercise it. (In re O'Brien, 29 Mont. 530, 75 Pac. 196; 8 Current Law, 36; Portland *v.* Cook, 48 Or. 550, 87 Pac. 772, 9 L. R. A., n. s., 733; 1 Abbott on Municipal Corporations, 209.) It would seem to follow, then, as a matter of course, that notwithstanding the length of time the city has enjoyed the privilege of discharging its sewage into the river, the State may, in the interest of the public health and safety, regulate such use, or if necessary, prevent the continuance of it. Indeed, if the State had consented to the use of the Yellowstone River by Miles City for the purpose of discharging its sewage therein, such consent would not have amounted to more than a license, which the State might revoke whenever public interests require it. (Portland *v.* Cook, above.)

But if it was possible for the city to have acquired the right which it asserts, that fact of itself would not preclude the State from enforcing any reasonable police regulations, even though such regulations called for an abandonment of the right asserted in the manner asserted; for all property is held subject to the right of the State to so regulate and control its use as to secure the general safety and public welfare. (City of Helena *v.* Kent, 32 Mont. 279, 80 Pac. 258; Cooley's Constitutional Limitations, p. 830.) And in the proper exercise of this police power one may even be restrained from doing a thing in itself lawful and right (City of Butte *v.* Paltrovich, 30 Mont. 18; 104 Am. St. Rep. 698; 75 Pac. 521), or may have his property destroyed, even though he himself is not at fault. (Cooley's Constitutional Limitations, p. 878.) In fact, the reason for the exercise of this power finds expression in the two maxims, "Sic utere tuo ut alienum non laedas" and "Salus populi suprema lex."

The statute does not deprive Miles City of any property right. It does not forbid the city using the Yellowstone River for the purpose of discharging its sewage, provided the sewage has been subjected to some practical means of purification. The statute looks only to a proper regulation of the use asserted and not to a denial of the use; and the mere fact that the city was making use of the river for discharging raw sewage into it at the time this statute was enacted, which modifies such use, is not any valid objection to the statute. (Cooley's Constitutional Limitations, 7th ed., chap. 16; Health Department *v.* Rector, 145 N. Y. 32, 45 Am. St. Rep. 579, 39 N. E. 833, 27 L. R. A. 710.)

SUCH LEGISLATION IS NOT RENDERED INVALID BY THE FACT THAT IT IS MADE APPLICABLE TO A PORTION OF THE STATE ONLY, PROVIDED NO UNREASONABLE OR ARBITRARY CLASSIFICATION BE ADOPTED.

In State Board of Health *v.* Greenville (86 Ohio St. 1, 98 N. E. 1019) the Ohio statute of April 7, 1908, entitled "An act to authorize the State board of health to require the purification of sewage and public

water supplies and protect streams against pollution," which is section 1249 et seq., General Code, was before the court. That statute contained a provision to the effect that no city or village which was discharging sewage into any river separating the State of Ohio from another State should be required to install sewage purification works as long as the unpurified sewage of cities or villages of any other State should be discharged into the river above such Ohio city or village. This provision was claimed to render the act unconstitutional. The court said:

* * * The fourth objection to this act of the general assembly urged by counsel for plaintiff in error in their printed briefs is as follows: "Said act being of a general nature, does not have uniform operation throughout the State, and is, therefore, in conflict with section 26 of Article II of the constitution of the State of Ohio. That portion of the act said to violate this provision of the constitution is as follows: '*Provided*, That no city or village that is now discharging sewage into any river which separates the State of Ohio from another State shall be required to install sewage purification works as long as the unpurified sewage of cities or villages in any other State is discharged into said river above said Ohio city or village.'"

This contention presents the most difficult question in this case. The act under consideration is beyond all question a law of a general nature and therefore is clearly subject to the prohibition of this section of the Constitution. It is suggested that if this exception, classification, or whatever it may be called, should be found to be unconstitutional, that portion alone of the statute should be declared void and the balance permitted to stand; but that can not be done, for the reason that the statute would then apply to the municipalities now excluded from its operation. A court may sometimes hold a portion of the statute unconstitutional and the balance of the statute valid, when the result would be to relieve persons or territory from the provisions of the statute; but it can never do this when the result would be to extend the law to additional persons or territory. To do this would be invading the province of the general assembly and would be legislating for territory never included by the general assembly in the operation of the statute. There is a provision, however, in this exception, as found in the original enactment, that a court might hold to be invalid and still sustain the residue of the original act, and that is in reference to cities that might hereafter come within the same class and condition as those now discharging sewage into the river. But whether it should do so or not with this particular act is now unimportant. In the General Code of Ohio the language of this section has been changed, and it now reads: "But no city or village discharging sewage into a river which separates the State of Ohio from another State," etc. Therefore the statute as it now reads exempts all cities that may now or hereafter discharge sewage into a river which separates the State of Ohio from another State so long as the unpurified sewage of cities or villages of another State is discharged into the river above such village or city of this State, and we take it that counsel are more particularly interested in having the constitutionality of the present law determined than in having this court answer a moot question.

The question then presented is whether the General Assembly of Ohio has attempted a classification or an exception which is a false, unnecessary, and arbitrary one, or whether it be reasonable, just, and necessary. This court has repeatedly held that classification is often proper and sometimes necessary in

legislation in order to define the objects on which the general law is to take effect, but has taken equally as firm a stand against any arbitrary, vicious, or faulty classification used to evade this constitutional limitation. (Gentsch *v.* State, 71 Ohio St. 151, 72 N. E. 900.) We take judicial notice of the fact that the Ohio River is the only river that comes within the terms of this exception. This river separates the State of Ohio from the States of Kentucky, West Virginia, and Pennsylvania. This court held in the case of Booth *v.* Shepherd (8 Ohio St. 243) that "The territorial limits of the State of Ohio extend on the southeast at least to the line of ordinary low-water mark on the northwest side of the Ohio River." The Northwest Territory was described in the cession by the States to the General Government as "territory situate, lying, and being to the northwest of the Ohio River," and it was held in the case of Handly *v.* Anthony (5 Wheat. 374, 5 U. S. (L. ed.) 113) that where "one State is the original proprietor and grants the territory on one side only, it retains the river within its own domain, and the newly created State extends to the river only." Neither of the States being a party to that litigation, this would not be a final adjudication with reference to their proprietary rights, but if the Ohio River is without the boundary of the State of Ohio and territory over which the general assembly has no control, as these adjudications would indicate, any attempt to legislate in reference thereto would necessarily be futile.

We are not concerned with the riparian rights of lower proprietors on the Ohio side of the Ohio River, nor with the remedy they may have for any private wrongs to these rights. In this inquiry we are only concerned with the authority of the State to extend its jurisdiction over the territory occupied by the Ohio River, and if that territory is not a part of the territory of Ohio, this exception, whether written into the law or not, must necessarily obtain, for even if the act by its terms included the Ohio River and that river is not a part of Ohio it would be extraterritorial and impossible of enforcement over that territory. This act in its title declares, among other things, that it is an act "to protect streams against pollution." This certainly refers to streams within and not without Ohio, and could not by any liberality of construction be held to include rivers beyond the State's territorial limits.

This is too important a question to determine in a cause where it arises only incidentally to the main issue in the case, especially when it is not necessary to the disposition of the case at bar, for if it be conceded that the territorial limit of the State extended to the center of the Ohio River, the objection would not necessarily be well taken. Every law is supposed to serve some purpose, and it would be absurd to impose burdens upon persons, corporations, villages, and cities that could not possibly work to the public good or operate to public advantage or the protection of private rights. One of the evident purposes of this act, and so declared in its title, is to prevent the pollution of streams, and where it is apparent that the State is powerless to prevent this pollution by reason of the control and authority of States bordering the opposite bank of a river, it would not only be folly but unjust and arbitrary to compel the citizens of this State to do or refrain from doing any act, the doing of which, or the refraining from which, would operate to no good purpose, either public or private.

It has been repeatedly held by this court that where a law is available in every part of the State as to all persons and things in the same condition or category it is of uniform operation throughout the State. (State *v.* Spellmire, 67 Ohio St. 77, 65 N. E. 619; Cincinnati *v.* Steinkamp, 54 Ohio St. 284, 43 N. E. 490; McGill *v.* State, 34 Ohio St. 228; State *v.* Bargus, 53 Ohio St. 94, 41 N. E. 245, 53 Am. St. Rep. 628.)

This law does operate uniformly in every part of the State upon all persons and things in the same condition or category. There is a substantial reason for excluding from the operation of this statute those persons, corporations, villages, and cities located on the banks of a stream that separates Ohio from another State. It is not an attempt by the general assembly of Ohio to avoid the limitation of this provision of the constitution by a false or faulty classification, but, on the contrary, is a fair and honest effort to legislate for all the people of the State without unjust or arbitrary discrimination in favor of one class to the advantage of another. To compel those persons, corporations, villages, and cities bordering upon the Ohio River to refrain from discharging sewage into the Ohio River while the cities on the opposite banks are so doing would serve no purpose and accomplish no good results. It would be an absurdity to impose useless burdens upon them, and the purposes of the statute would be no nearer accomplished than by excluding them from the operation of the law. It would be so unjust and arbitrary as to shock the public conscience. The fact that it would be productive of no good results is sufficient reason for the classification and for exempting them from the provisions of this law. The strongest argument that can be made against this classification is that the law divides the people and cities of the State into two classes, distinguishable only by the condition surrounding each. One class is compelled to do and refrain from doing certain things, because the doing or refraining from doing will operate to the substantial benefit of all the people of the State. The other class is exempted from doing and refraining to do the same things because their doing or refraining from doing these things would operate to nobody's advantage. It would seem that it would not require a Solomon to determine that this is not an unjust or unfair discrimination or false or faulty classification, and that notwithstanding this exception the law does operate uniformly as to all persons and things in the same condition or category. Classification is not only proper, but sometimes absolutely necessary in legislation. It is only when there is no substantial reason for the classification, when it clearly appears that there is no real difference existing and that classification has been resorted to by the general assembly merely for the purpose of avoiding and escaping the constitutional limitation, that a court will declare a statute unconstitutional for this reason.

So in State *v.* Griffin (69 N. H. 1, 76 Am. St. Rep. 139, 39 Atl. 260, 41 L. R. A. 177), where a statute was passed prohibiting the deposit of sawdust in the tributaries of Massabesic Lake, which lake is a source of water supply of the city of Manchester. The defendant was convicted for violation of the statute and contended that it was unconstitutional, as not being an equal and uniform law. The New Hampshire court said:

A law that confers equal rights on all citizens of the State, or subjects them to equal burdens, and inflicts equal penalties on every person who violates it, is an equal law, though no one can enjoy the right, be subjected to the burden or infringe its provisions, without going to or being in a particular part of the State. It does not discriminate in favor of some at the expense of others. There are places regarding which any protective legislation must necessarily be special.

And in the case of State Board of Health *v.* Diamond Mills Paper Co. (63 N. J. Eq. 111, affirmed in 64 N. J. Eq. 743, 53 Atl. 1125), a suit in equity was brought under a statute prohibiting the discharge of polluting matter of any kind whatsoever into any brook, stream,

or reservoir from which a public water supply is taken. The act excepted from this provision any municipality "which at the date of the passage of this act has a public sewer or system of sewers, drains or system of drains, legally constructed under municipal or township authority discharging its drainage as sewage into such river, etc."

The court said:

It is urged that the act is objectionable because it exempts from penalty municipalities which, at the date of its passage, have legally constructed sewers discharging their sewage into rivers and streams; that it is, therefore, special because its prohibitions act upon some municipalities and not upon others, and local because it exempts from its operation parts of some streams, viz, those into which sewage is now flowing. The argument, of course, goes to this extent, that the legislature has no power, except by private, local, or special bill, of which notice is given, to preserve the waters of the State in their present condition of purity, without exacting the impossible requirement that all water courses from their source to their mouth shall be hereafter kept pure and potable. I think that waters which either are or, under existing law, ought to be pure and potable, may properly be put into a class by themselves. I think further that, having regard to the geography of the State and the shortness of its water courses, the potable waters of the State may be properly classified as those which are above the points of lawful sewage discharge and the non-potable as those which are below such points. There is always a possibility that the germs of disease and epidemic may be present in streams and waters of the latter class, however much the sewage and drainage may be diluted, and it is reasonably certain that even if in some cases conditions may be improved, the waters below the points of present discharge will never regain their original purity. As to the class of potable waters, the prohibition binds all alike.

MOST COURTS CONSTRUE STRICTLY STATUTES FOR THIS PURPOSE AND HOLD THAT SUCH CONSTRUCTION DOES NOT RENDER THEM UNCONSTITUTIONAL.

In State *v.* Wheeler (44 N. J. L. 88) "An act to prevent the willful pollution of the waters of any of the creeks, ponds, or brooks of the State," made it a misdemeanor to throw any carcass, offal, or other offensive matter into any creek, pond, or brook, the waters of which are used to supply any acqueduct or reservoir for distribution for public use. A conviction having been had under the statute, the respondent appealed and contended that the lower court had erred in refusing to charge the jury that unless the respondents' acts were calculated to render the water as supplied to reservoirs impure or offensive, they could not be convicted, and that if a construction of the act in accordance with a request to charge as above were not adopted, then the statute would be unconstitutional, as depriving an owner of property of its use without compensation.

The court overruled these contentions and said:

The whole act plainly shows a design to protect from pollution the waters of creeks, etc., used as the feeders of reservoirs for public use, without any refer-

ence to whether such pollution in fact appreciably affects the water when arrived at the reservoir.

Nor does such a construction render this act objectionable. The design of the act is not to take property for public use, nor does it do so within the meaning of the constitution. It is intended to restrain and regulate the use of private property so as to protect the common right of all the citizens of the State. Such acts are plainly within the police power of the legislature, which power is the mere application to the whole community of the maxim, "Sic utere tuo, ut alienum non laedas." Nor does such a restraint, although it may interfere with the profitable use of property by its owner, make it an appropriation to a public use so as to entitle him to compensation. (Citing Comm. *v.* Alger, 9 Cush. 53; Comm. *v.* Tewksbury, 11 Metc. 55; and other cases.) * * *

Nor is there anything to render such legislation objectionable because in some instances it may restrain the profitable use of private property, where such use, in fact, does not directly injure the public in comfort and health. For to limit such legislation to cases where actual injury has occurred would be to deprive it of its most effective force. Its design is preventive, and to be effective it must be able to restrain acts which tend to produce public injury. Many instances of the exercise of such power may be found (citing instances). * * * The object of this legislation is to protect the public comfort and health. For that purpose the legislature may restrain any use of private property which tends to the injury of those public interests. That the pollution of the courses of the public water supply does so tend, no one can deny.

In City of Durham *v.* Eno Cotton Mills (141 N. C. 615, 54 S. E. 453, 7 L. R. A. (N. S.) 321), a statute (revisal 1905, sec. 3051) provided that—

No person or municipality shall flow or discharge sewage into any drain, brook, creek, or river from which a public drinking-water supply is taken, unless the same shall have been passed through some well-known system of sewage purification approved by the State board of health; and the continual flow and discharge of such sewage may be enjoined upon application of any person.

Plaintiffs, a city and a water company, sued the defendant for injunction. The defendant contended that because the sewage from the defendant's mill was emptied into the river some 17 miles below the intake of the water company, to hold the statute applicable would involve an unconstitutional taking of the defendant's property without compensation, but the court said:

It will be observed by reading the act that it is not required that the sewage discharged into the stream should injuriously affect the water at the intake; it is quite sufficient if it pollutes the river at the sewer's outlet. The legislature has decided that it is desirable to preserve our natural streams in at least their present state of purity, and where they have been polluted, to remove the cause as speedily and effectually as possible. It has therefore said that no person shall deteriorate the water at all by sending sewage into a natural stream, until it has been purified and made wholesome, or until all the noxious matter in it has been eliminated. All this means, of course, that the water shall not be poisoned by sewage at the outfall. We must assume that the defilement of the water is an injury which is forbidden by the legislature for perfectly good and sufficient reasons. It is not for us to question the policy or expediency of such an enactment. In this respect the legislature has a large discretion, to be

exercised in such way as will, in its judgment, promote the interests and advance the welfare of the people, and it has this discretion to such an extent as to be virtually a law unto itself so far as the manner of its exercise is concerned. Such legislation is not intended merely to abate an existing nuisance, but to prevent that being done which is a menace to the public health, and which it is supposed may become a deadly peril and a public nuisance because fatal in its consequences. It is not, therefore, a void law because it is founded upon a mere apprehension of evil, but is a precautionary measure which is clearly within the police power of the State and to be adopted when deemed necessary to secure the public health. * * *

And quoted with approval the above language from State *v.* Wheeler (44 N. J. L.)

And in State Board of Health *v.* Diamond Mills Paper Co. (63 N. J. Eq. 111, affirmed in 64 N. J. Eq. 743, 53 Atl. 1125), where the State Board of Health of New Jersey brought suit for injunction to prevent the defendant from discharging polluting matter into Rahway River, in violation of a statute which prohibits the discharged of—

Sewage, drainage, domestic or factory refuse, excremental or other polluting matter of any kind whatsoever, which either by itself or in connection with other matter, will corrupt or impair or tend to corrupt or impair the quality of the water of any river, brook, stream, or any tributary or branch thereof or of any lake, pond, well, spring, or other reservoir from which is taken or may be taken any public supply of water for domestic use in any city, town, borough, township, or other municipality of this State, or which will render or tend to render such water injurious to health, above the point from which any city, town, etc., shall or may obtain its supply of water for domestic use.

The defendant contended that the point of the discharge of the polluting matter, which was sought to enjoin, was some 8 miles above the intake of Rahway City and that the water was not polluted when it arrived at the intake, or at least it was not shown, and the defendant contended that to enjoin him under such circumstances would be unconstitutional, as taking of private property for public use without compensation, but the court denied the contention upon the authority of State *v.* Wheeler. It was pointed out, however, that if the city had been suing it would have been obliged to show actual injury in order to entitle it to relief, but that in this case the action was not brought by the city but by the board of health, which was authorized to sue under the statute and need not show actual injury.

In State of West Virginia *v.* Southern Coal & Transportation Co. (71 W. Va. 470; 76 S. E. 970; 43 L. R. A. (N. S.) 401) the defendant company was indicted for violating a statute (see 2768 of the Code of 1906) which provided:

It shall be unlawful for any person, firm, or corporation to throw in, or allow to enter, any stream or watercourse in this State, sawdust or any other matter deleterious to the propagation of fish.

It was contended that the indictment was defective because it failed to show that the stream, into which defendant was charged with casting sulphur water, was adapted to the propagation of fish. But the contention was overruled, the reasoning being that the legislative intent being to protect the fish in the State, this was to be accomplished only by protecting all streams, since polluting matter cast into one would flow into another and destroy fish.

In Miles City *v.* Board of Health (39 Mont. 405, 102 Pac. 696, 25 L. R. A. (N. S.) 589), decided July 3, 1909, the defendant city planned to discharge its sewage into Yellowstone River. The board of health issued an order prohibiting the installation of such an outlet and ordered and directed "that the said Miles City, at as early a date as practicable dispose of the sewage of said city in some sanitary manner, acceptable to the said State board of health." The city appealed from the order to the district court. The order was annulled and the board appealed to the supreme court and the supreme court overruled the district court and upheld the board. In the course of the opinion it was said:

* * * Counsel for the city misapprehend the scope of this statute. The prohibition is against the pollution of the waters of a stream which is a source of water supply. Assuming for the purposes of this appeal, as counsel did upon the oral argument, that the reference in the order of the board is to the city of Glendive particularly, and assuming, further, that the intake of the Glendive water supply is many miles below the outflow of the Miles City sewer, the order of the board, on its face, is still justified, for the prohibition is not directed against polluting them at such outfall. The prohibition is against polluting the waters at any place within the State, and it is therefore wholly immaterial that the putrescible constituents of the sewage are not carried to the intake of the Glendive water supply, if such be the fact. The State, in the valid exercise of its police power, has said by this statute, that hereafter no polluting sewage and no human excrement shall be discharged into any stream which is the source of water supply for a city or town, until such deleterious matter is rendered harmless by some means of sewage purification acceptable to the State board of health. In Durham *v.* Eno Cotton Mills (141 N. C. 615,7 L. R. A. (N. S.) 321), the court had under consideration a similar statute, and reached the same conclusion which we have indicated above.

It has been seriously suggested, however, that the strict construction placed upon this class of statutes in cases like the above carries the courts beyond the limitations imposed by the Constitution.

Thus in a case note accompanying the report of the City of Durham *v.* Eno Cotton Mills (7. L. R. A. (N. S.) 321) it is argued that it is the right of the riparian owner to cast a certain amount of polluting matter into the stream (citing 1 Farnham on Waters 288); that this is a property right which can not be taken away without compensation or due process of law and that "it would seem that the arbitrary declaration by the legislature that he should no longer enjoy his property right without anything to show that it

was necessary for the public health was surely a deprivation of property and that it was without compensation and without due process of law." It was further said: "The fact of public necessity being the basis of the police power, that fact should be apparent to justify an exercise of the power." No direct authority is cited by the author to sustain this position, and it is believed that the position taken in the note is against the weight of authority. Even so, however, the note is very suggestive of the possibility of doing needless harm to riparian owners through the severity of statutes of this kind and also through a too literal interpretation.

In Commonwealth *v.* Straight Creek Coal & Coke Co. (147 Ky. 790), decided April 18, 1912, defendant was indicted for discharging sawdust into a stream in violation of a statute prohibiting the discharge into streams of substances that would sicken, intoxicate, or kill fish, or render the water unfit, or produce a stench. Defendant demurred to the indictment, contending that sawdust not being one of the substances enumerated in the statute and not of the class of the substances that were enumerated, it could not have been within the intent of the statute. But the demurrer was overruled, it being held that the legislative intent evidently was to prohibit "the putting into the water of 'anything' or 'any substance' whatever it might be, that would cause fish to be sickened, intoxicated, or killed, or render the water unfit for use, or produce a stench."

SOME COURTS HAVE HELD THAT STATUTES ENACTED FOR THE PRESERVATION OF STREAMS SHOULD BE LIBERALLY CONSTRUED IN FAVOR OF THE RIPARIAN OWNER.

Thus in the case of Cartwright *v.* Canandaigua Gas-Light Co. (32 Hun. 403), decided 1884, a New York statute entitled "An act for the preservation of moose, wild deer, birds, fish, and other game," contained in this provision, section 25:

> No person, association, company, or corporation shall throw or deposit, or permit to be thrown or deposited, any dyestuff, coal tar, refuse from gas houses, sawdust, lime, or other deleterious substance, or cause the same to run or flow into or upon any of the rivers, lakes, ponds, streams, or any of the bays or inlets adjoining the Atlantic Ocean, within the limits of this State. Any person who shall violate this section, or any member of any such company, association, or corporation who shall authorize any such violation shall be guilty of a misdemeanor, and in addition thereto shall be liable to a penalty of $50 for each offense. But this section shall not apply to streams of flowing or tidewater which constitute the motive power of the machinery of manufacturing establishments when it is absolutely necessary for the manufacturing purposes carried on in such establishments to run the refuse matter and material thereof into such stream.

The defendant was charged with a violation of this section by discharging into a small stream which flows into Canandaigua Lake refuse substances resulting from a distillation of coal in generating

gas. The evidence did not show very definitely how much of this matter was cast into the stream, but it appeared to have varied in quantity and to have continued for several months before the commencement of the action. The court said:

This act of the defendant clearly amounts to throwing and depositing in the stream the refuse arising from its manufacture of gas. There has been a literal violation of the restraining clause of the statute. (The court then overrules a contention of the defendant that a corporation is not a "person" contemplated by the act.)

A more doubtful question arises, whether under all the proofs a case has been made out establishing that the defendant has been guilty of violating the meaning and purpose of the statute so as to incur the penalty. There is no evidence, not the least, that the waters of the stream or of Canandaigua Lake, into which it flows, have been polluted in such a degree by reason of flowing the refuse matter of the gas factory into the same as to become deleterious and destructive to the life or disturbing to the habits of fish. The proofs presented upon the subject came from the defendant and tended to prove that fish continued to frequent the stream and were not killed or disturbed by reason of permitting the refuse matter to escape therein.

It is manifest that the language of the statute can not be taken literally, because the throwing or depositing of any of the many substances mentioned into a stream or lake, however small the quantity or large the body of water, would be a technical violation of the language of the statute. To constitute a violation of the statute, the quantity of material thrown into a body of water must be such as to have the effect of destroying life or disturbing the habits of fish, in some degree, otherwise the statute would be absurd, harsh, and absolutely unnecessary. By the language of the section it is manifest that it was the intention of the legislature that the acts prohibited must be such as to be deleterious in fact; that is, destructive of the life of fish. The adjective "deleterious" as used at the close of the prohibitory clause has the effect, and we think such was the intention of the legislature in using the same, to limit and qualify the meaning of the previous general words of the paragraph. The common and generally accepted meaning of the word is, "having the power of destroying or extinguishing life; that which is destructive, poisonous, pernicious; as deleterious plant or quality." (Webster.)

* * * It is a maxim in construing penal statutes when general words are used, to restrain their meaning for the benefit of the person against whom the penalty is inflicted. (Devanis, 736; Hall *v.* Siegel, 7 Lans. 206.)

It is the duty of courts to so construe statutes as to resist the mischief which the law was intended to remedy. The object and purpose of this statute is disclosed in its title, "for the preservation of fish and other game." Unless some act be done which has the effect in some degree of destroying fish or game, no penalty can be incurred by anyone. In commenting upon a statute, penal in its character, Earl, J., said: "It can not be doubted that the lawmakers did not intend that this law should be applied in such cases; and yet they are within the letter of the law. The lawmakers can not always foresee all the possible applications of the general language they use; and it frequently becomes the duty of the courts in construing statutes to limit their operation so that they shall not produce absurd, unjust, or inconvenient results not contemplated as intended. A case may be within the letter of the law and yet not within the intent of the lawmakers, and in such a case a limitation or exception must be implied." (L. S. & M. S. R. R. Co *v.* Roach, 80 N. Y. 339, 344.)

Very pertinently these observations are applicable to the construction of this statute and can be properly adopted in disposing of the case before us. The justice's return states that it contains all the evidence given on the trial, and for the reason it does not appear that the quantity of coal tar and other refuse material thrown into the stream by defendant from its factory is destructive to the life or disturbing to habits of fish, we hold that the plaintiff failed to prove a violation of the statute in this instance.

And the later cases in New York appear to hold that this class of statutes must be so liberally construed as not to take away riparian rights unless compensation be provided and that a different construction would render the act unconstitutional. Such seem to be the holdings in—

George *v.* Village of Chester, 59 Misc. 553.
People ex rel. Goff *v.* Kirk, 65 Misc. 657.

It may be that any use of the waters of a stream, however long continued, is liable to be controlled, impaired, or destroyed if the legislature of the State shall treat the existence of such a use as incompatible with the health, safety, and welfare of the community, and that, even if the market value of the property is diminished, no right is violated, as the mode in which property is enjoyed may be subject to the rights of all in their health and safety and subordinate to general laws established for their protection. (Commonwealth *v.* Upton, 6 Gray, 473.) When a long-established use of water in a respectable and necessary business is thus impaired or destroyed by legislation, it will be so clearly by express terms or necessary inference, and, if done for the benefit of others, proper compensation will be made therefor. * * * The town "could not expect riparian owners to surrender rights * * * unless they were, in the interest of public welfare, by a general law forbidden to exercise them, or unless proper compensation was provided therefor."

And in Walker et al. *v.* City of Aurora (140 Ill. 402):

The discharge of the proposed system of sewerage is into Fox River, and it is objected that such discharge would contaminate the waters of the stream and be a public nuisance and in violation of paragraphs 2 and 3 of section 277 of the Criminal Code (1 Starr and Curtis's Stats. chap. 38, sec. 277), one of which paragraphs provides that it is a public nuisance to throw or deposit any offal or other offensive matter, or the carcass of any animal, in any watercourse, lake, pond, spring, well or common sewer, street, or public highway, and the other that it is a public nuisance to corrupt or render unwholesome the water of any spring, river, stream, pond, or lake to the injury or prejudice of others. It would be unreasonable and would lead to seriously injurious results if these statutory provisions were construed as showing a legislative intention to absolutely prohibit cities and towns located upon the shores of lakes or banks of rivers from emptying their sewerage into such lakes or rivers. In view of the opinions expressed by expert witnesses and of the quantity of water flowing in Fox River, the rapidity of its current, the tendency of the river to purify itself, the dilution of the sewage by surface and spring water and water from the waterworks before it reaches the mouth of the sewer, we think that the pollution of the water of the river would be very inconsiderable, and perhaps even barely perceptible near the mouth of the sewer. It is suggested that the sewage will be a nuisance to the cities and towns on Fox River below Aurora. If this should turn out to be so, and if the discharge of the sewage into the river should prove to be "to the injury or prejudice of others," and if appellee

should fail to provide suitable appliances for the purification of the sewage matter, then there will be ample opportunity to afford relief, upon complaint being made, either on behalf of the public or of those injured or prejudiced.

And again in the case of New York *v.* Blum (208 N. Y. 237), decided April 22, 1913, while the court sustained the granting of an injunction against the defendant, who was maintaining some 200 ducks upon a pond to the injury of the water supply of the city of Brooklyn, the court rested its decision not upon the fact that the defendant was violating the rules established by the State board of health but upon the fact that his use of the pond was unreasonable in view of all of the circumstances. It was said:

The (trial) court found that the acts of the defendant are violations of certain rules of the State board of health. The question of preserving potable waters from pollution is growing in importance with the increasing density of the population and the growth of urban communities. But we do not consider it necessary to pass upon the effect of those rules or to determine what the State may do in the exercise of the police power to prevent the pollution of potable waters in the interest of the public health and the general welfare, because we have reached the conclusion that, wholly apart from said rules, the trial court was justified in deciding that the defendant was making an unreasonable use of the waters of Prices Stream as matter of fact if not as matter of law.

An English case in which a statute is interpreted liberally in favor of the defendants charged with violating it by polluting the stream is that of Attorney General *v.* Birmingham, Tame, and Rea District Drainage Board (L. R. Chan. Div. 1910, Vol. I, p. 48):

Nothing in this act shall authorize any local authority to make or use any sewer drain or outfall for the purpose of conveying sewage or filthy water into any natural stream or watercourse, or into any canal, pond, or lake, until such sewage or filthy water is freed from all excrementitious or other foul or noxious matter such as would affect or deteriorate the purity and quality of the water in such stream or watercourse or in such stream, pond, or lake.

The attorney general, at the relation of the corporation of Tamworth and others, sought under that section to enjoin the defendants, a drainage board organized under the act, from continuing to discharge sewage from their sewage farm into the River Tame. An eminent chemist, appointed by the court to report upon conditions found, reported that the water of the river, which was somewhat polluted when it reached defendant's works, was not rendered more impure by the discharge of sewage from defendant's plant. The following is from the opinion of the master of the rolls:

Now, is that an absolute prohibition against conveying any filthy water into any natural stream, or is it only a prohibition against conveying filthy or sewage water in such a manner as to prejudicially affect or deteriorate?

It seems to me hardly reasonable to say that a man can be guilty of a statutory offense under this section if he has improved the water by that which he casts into it. I think, therefore, that the question which we submitted to Sir

William Ramsay was the proper question to submit in a case like this, and that it is not true to say that there has been a statutory offense if the defendants have put into the river some water which does contain a certain amount of filth, although it is so much better than the rest of the water which was in it before that upon the whole it improves the character of the water. In other words, it can not be said to deteriorate the purity of the water; on the contrary, it benefits it; and we must read the word "affect" in the sense of prejudicially affect or deteriorate the purity and quality of the water.

Two other concurring opinions were written and the injunction denied.

And in the case of People *v.* La Pell (128 App. Div. (New York) 709), decided in November, 1908, the defendant, a sawmill proprietor, was sued for penalties for violation of a statute (Laws of 1900, ch. 20, sec. 52) forbidding the discharge of "sawdust, shavings, * * * or other deleterious or poisonous substance" into any "waters in quantities destructive of fish inhabiting the same." A judgment was obtained against the defendant and an appeal taken to the appellate division, third department. "There was proof that there were fish in the stream, but there was no proof that any fish had been destroyed by the sawdust or shavings." A number of witnesses testified regarding the amount of sawdust which the defendant discharged into the stream, following which an expert was asked a hypothetical question based upon the other testimony in the case, and he testified that the effect would be to destroy the stream as a spawning ground and that "the effect on the fish would be to drive them out or kill them." The court reversed the judgment on the ground that the prohibition contained in the statute "is not against throwing them (sawdust and shavings) in in quantities sufficient to destroy a stream as a spawning ground, but against throwing them in in quantities destructive of fish."

In the case of Staffordshire County Council *v.* Seisdon Rural District Council (96 Law Times Reports, 328) an action was brought under the rivers pollution prevention act of 1876 to prevent the discharge of sewage into the River Stour. The county court had been asked to make an order under the provisions of section 10 and had refused to do so. The plaintiff appealed.

It appeared that the River Stour was somewhat polluted when it reached the point at which this sewage entered, and it appears to have been the contention of the defendants not that the pollution of the river above furnished a complete excuse for its further pollution at this point, but that the condition of the river when it reached this point of discharge was such that the discharge became a trivial thing that the court ought to disregard. The Court of King's Bench refused to so hold. Two opinions were written, both holding that the order should have been made by the county court.

Darling, J., in his opinion, said:

The statute does not mean that rivers must not be what you call appreciably polluted by one person in addition to others who have already polluted it.

Phillimore, J., in his opinion said:

If there is a percentage of pollution delivered from this village, which only brings the total percentage of pollution to that existing higher up the river, then the Staffordshire County Council are entitled to an order. The late Dr. Melmouth Tidy used to say that a river during its course tended to purify itself by a process of oxydization, especially when falling over weirs and waterfalls, and also if there is any accretion of the volume of water from springs that would have a purifying effect. If, in such circumstances, when the river passed through this village it received back a percentage of the pollution it had lost and a claim was made that such pollution should not be removed, that must not be, and if that learned judge meant by his decision to hold the contrary he was wrong in law.

And further said:

When there is something more of pollution than that minimum of which the law takes no heed, there must be some form or other for prohibiting it.

A STATE MAY LEAVE TO A COMMISSION OR BOARD THE DETAILS OF LEGISLATION FOR PROTECTION OF ITS WATERS.

By the constitutions of the several States the legislatures are given the power to make laws. The general proposition is well established that this power to enact legislation can not be redelegated by the lawmaking body to others, the reason being that the people have placed this power in their legislatures in reliance upon the patriotism and ability of those bodies. (Cooley, Constitutional Limitations, 7th ed., p. 163.)

Nevertheless, while recognizing this general principle, the Massachusetts Supreme Court has held in numerous cases that the legislature may leave to a board or commission the details of legislation; that is to say, instead of enacting a law which definitely marks that which is legal from that which is illegal in regard to pollution of streams, the legislature may leave to a board or commission the final determination of what must be forbidden and what may be permitted.

For example, in legislating to prevent the pollution of streams by sawdust to the detriment of fish life therein the legislature did not name the streams into which it should be illegal to discharge sawdust, but provided that if the board of commissioners of fish and game should "determine that the fish of any brook or stream in this Commonwealth are of sufficient value to warrant the prohibition or regulation of the discharge therein of sawdust from sawmills and that the discharge of sawdust from any particular sawmill materially injures such fish" it should issue an order prohibiting the discharge of sawdust from that mill and that violation of such order should be punishable by fine.

In the case of Commonwealth *v.* Sisson (189 Mass. 247), decided October 17, 1905, the defendants had been served with an order and had been convicted of violating it. In sustaining the conviction the Supreme Court of Massachusetts said:

We are of opinion in the first place that it is within the power of the legislature to protect and preserve edible fish in the rivers and brooks of the Commonwealth, and for that purpose, if they think proper, to forbid any sawdust being discharged into any brook containing such fish. * * *

We are of opinion in the second place that in case the legislature thought that in regulating the conflicting rights of individuals to run sawmills on the banks of a river on the one hand, and of the public on the other hand to have fish live and increase in the same stream, it was not worth while to forbid sawdust being discharged into every stream in which there were edible fish, they could leave to a board having peculiar knowledge on the subject the selection of the brooks and rivers in which the fish were of sufficient value to warrant the prohibition or regulation of the discharge of sawdust. The right of the legislature to delegate some legislative functions to State boards was considered by this court on Brodbine *v.* Revere (182 Mass. 598).

And further, in case the legislature thought that an act which forbade any sawdust to be discharged into any of the streams selected by the board was an unnecessarily stringent one, they could in our opinion leave it to the board to settle in each particular case the practical details required to harmonize best these two conflicting rights.

The result is that in our opinion the action of the board in the case at bar was the working out of details under a legislative act. The board is no more required to act on sworn evidence than is the legislature itself, and no more than in the case of the legislature itself is it bound to act only after a hearing or to give a hearing to the plaintiff when he asks for one; and its action is final as is the action of the legislature in enacting a statute. And being legislative it is plain that the questions of fact passed upon by the commissioners in adopting the provisions enacted by them can not be tried over by the court. This court has been recently asked to try over the expediency of compulsory vaccination in an action under a statute requiring it. (Commonwealth *v.* Jacobson, 183 Mass. 242.) On its decline to do so an appeal was taken to the Supreme Court of the United States, and its refusal to do so was held to be correct. (Jacobson *v.* Mass. 197 U. S. 11; see particularly p. 30. See also Devens, J., in Train *v.* Boston Disinfecting Co. 144 Mass. 523, 531.)

The practical result is that the defendants are forbidden to conduct their sawmill as they had conducted it for 30 years by a board who have not heard evidence and who have refused the defendants a hearing; that the action of the board is final, and that no compensation is due to them.

This result may seem strange. But it is no less strange than the practical results in cases which are decided by law. Take the case before the court in Nelson *v.* State Board of Health (186 Mass. 330), namely, a farm on the banks of a pond used as the water supply of a town. The State board of health can pass a general regulation, under section 113, Revised Laws, chapter 75, forbidding privies within a specified distance from its shore; and if the defendant had had a privy there for 30 years his right to maintain it would cease, although the order was made without hearing; and the action of the board is final. On the other hand, if the board had proceeded under section 118 to investigate this particular privy, the defendant would have been entitled to a hearing and, on appeal, to a jury, as provided by section 119. * * *

It is interesting to note that apparently as the result of this decision the legislature the very next year amended the act by requiring the commissioners to grant a public hearing before issuing an order, by making the issuance of the order a matter of discretion with the commissioners, and by providing that any party aggrieved by any order might file a petition in equity to have it annulled or modified.

In the case of John H. Nelson v. State Board of Health, cited by the Massachusetts Supreme Court (supra), the opinion goes into the history of the health legislation in the State to some extent to show that two kinds of power have been given to the local boards of health and likewise the same two kinds to the State boards; that is, first, the quasi legislative power to make rules and regulations, and, second, the quasi judicial power to make orders requiring the cessation of a particular nuisance, and in sustaining the conviction of Nelson for the violation of rules and regulations passed by the State board of health for the sanitary protection of Elders Pond and Assawompsett Pond and their tributaries, which were the source of water supply of the city of Taunton, held that the rules there issued were quasi legislative acts under the legislative power of the board, that they were final, and that the necessity for them was not subject to judicial review.

That the State may delegate to a board or commission the details of an act for the preservation of its streams was also held in the case of State Board of Health et al. *v.* City of Greenville et al. (86 Ohio St. 1), decided January, 1912, and in Welch *v.* Coglan (126 Md. 1), decided April 14, 1915. The Maryland statute specifically provides that the reasonableness of orders issued by the State board of health is subject to judicial review. The Supreme Court of Maryland said:

> It scarcely needs to be said that the reasonableness of the exercise of any such power as that entrusted to the State board of health by the act of 1914 is always open to question (State *v.* Gurry, 121 Md. 541), and it is expressly made so by the provisions of section 18 of the act.

In that case the question of the reasonableness of the regulations had not been raised, and the supreme court, instead of making a final disposition of the case, sent it back with instructions to permit an amendment to raise the question of reasonableness.

Generally speaking, the statutes which delegate the authority and control over the streams and water supplies to boards of health, etc., permit the rulings of such boards to be tested in the courts as to their reasonableness.

In Ohio the statute provides for an appeal to a board of engineers, who are to act as arbitrators and whose decision should be final. In the case of State Board of Health et al. *v.* City of Greenville et al. (supra), the constitutionality of the act was challenged

upon the ground that it provided for compulsory arbitration and was a violation of the constitutional provision of the State of Ohio, guaranteeing the right of trial by jury. The question, however, was raised not by an individual but by a municipality. The Ohio Supreme Court held that a municipality did not come under the ægis of the constitutional provision and sustained the act so far as its applicability to municipalities is concerned. The opinion leaves some question as to the validity of the act as applied to individuals.

THE POWER OF THE STATE TO AUTHORIZE THE DISCHARGE OF SEWAGE INTO STREAMS TO THE INJURY OF LOWER PROPRIETORS IS LIMITED BY CONSTITUTIONAL PROVISIONS.

It has been seen that according to most courts, under the police power, a State may legislate to protect the purity of its streams, even by means of markedly curtailing the common-law rights of riparian proprietors to pollute the same to a reasonable extent, and that this may be done without making compensation to those proprietors whose rights are thus curtailed. But when the State seeks to authorize the discharge of sewage into a stream to the detriment of a lower riparian proprietor an important constitutional question arises, namely, whether such discharge would constitute a taking of the property of lower riparian owners within the meaning of the constitutional provision of the State.

The Federal constitutional provision does not apply.

Although the Constitution of the United States provides that private property shall not be taken for public use without just compensation, it is well settled that this is a limitation on the power of the Federal Government and not on the States. (Pumpelly *v.* Green Bay & Mississippi Canal Co., 13 Wall. 166, 20 L. Ed. 557.)

But "this limitation on the exercise of the right of eminent domain is so essentially a part of American constitutional law that it is believed that no State is now without it." (Ibid.)

The United States Supreme Court has held that the provision of the Federal Constitution applies not only to a case where the actual title to the property is taken, but likewise to one where there is such a physical invasion of an owner's property as to substantially deprive him of all beneficial use.

Pumpelly *v.* Green Bay & Mississippi Canal Co., 13 Wall. 166, 20 L. ed. 557.

United States *v.* Lynah, 188 U. S. 445.

The United States Supreme Court has practically limited the doctrine, however, to cases in which there has been substantially a physical taking of the property, depriving the owner thereof of all beneficial use.

Thus in United States *v.* Lynah the principal opinion reviews a number of cases in which it was held that there was no taking of property and distinguishes them all upon the ground either that there was no actual invasion of the premises or that such invasion was not permanent, and the opinion approves the case of Mills *v.* United States (46 Fed. Rep. 738), which was an action growing out of the same improvement as that which caused the injury in United States *v.* Lynah, but where it was found that the injury could be remedied at an expense of some $10,000 in erecting levees around the plaintiff's rice fields to prevent flooding the fields at high water.

Obviously (said the Supreme Court) there was no taking of the plaintiff's lands, but simply an injury which could be remedied at an expense as alleged of $10,000, and the action was one to recover the amount of this consequential injury. The court rightfully held that it could not be sustained. Here there is no finding, no suggestion, that by any expense the flooding could be averted. We may, of course, know that there is theoretically no limit to that which engineering skill may accomplish. We know that vast tracts have in different parts of the world been reclaimed by levees and other works, and so we may believe that this flooding may be prevented, that some day all these submerged lands may be reclaimed. But, as a practical matter and for the purposes of this case, we must under the findings regard the lands in controversy as irreclaimable and their value wholly and finally destroyed.

And in Manigault *v.* Springs (199 U. S. 484) Mr. Justice Brown, after mentioning a number of cases in which this question had been before the court, said:

We think the rule to be gathered from these cases is that where there is a practical destruction or material impairment of the value of plaintiff's lands there is no taking which demands compensation, but otherwise where, as in this case, plaintiff is merely put to some extra expense in warding off the consequences of the overflow.

But the decisions of the United States Supreme Court do not control the question in the various States for two reasons—in the first place, the decisions of the United States Supreme Court, while entitled to and receiving great weight and consideration in the various States, are not authority in the State courts; and in the second place, the constitutional provisions of the various States are not all framed in the same language.

The provisions of the constitutions of many of the States are similar to the Federal provision; that is, they prohibit the "taking" of private property for public purposes without just compensation. Probably under that provision no State court would refuse to follow the United States Supreme Court as far as it has gone; that is to say, to the extent of holding that an actual physical invasion of property, depriving the owner thereof of substantially all beneficial use of it would amount to such a taking as would be within the language of the provision.

The Massachusetts Supreme Court in Diamond *v.* North Attleborough (219 Mass. 587), decided December 31, 1914, had before it the case of an overflow of a brook by the defendant city with the result that plaintiff's land was submerged and a portion of it washed away.

The Massachusetts Supreme Court held that although the city was acting under the authority of a statute and with the approval of the State board of health, the injury to the plaintiff constituted a trespass and might, if continued, amount to an appropriation of his property. The court said:

> The plaintiffs' complaint is that a part of their land has been submerged by the enlarged flow of the stream and some of it washed away by the increased force of its current. This, in substance and effect, is a trespass. If continued permanently by legal authority, it may become an appropriation. (United States *v.* Lynah, 188 U. S. 445, 464; Manigault *v.* Springs, 199 U. S. 473, 484.)

And in Williams *v.* Haile Gold Mining Co. (85 S. C. 1, 66 S. E. 117), decided November 23, 1909, where the defendant company discharged refuse matter into a stream with the result that there was an overflow and a deposit of débris on the plaintiff's land and such injury to plant life thereon that it became necessary for him to abandon the cultivation of his land, plaintiff recovered damages and an injunction. In sustaining the lower court in granting the injunction, the Supreme Court of South Carolina said:

> It has been too frequently held by this court to require further discussion that, when the existence of a nuisance has been established by the verdict of a jury, the party injured is entitled as a matter of right to an injunction to prevent its continuance. (Threatt *v.* Mining Co., 49 S. E. 95, 26 S. E. 970; Mason *v.* Apalache, 81 S. C. 554, 62 S. E. 399, 871.) Whatever may be the doctrine in other States, under the provisions of the constitution of this State, that private property shall not be taken for private use without the consent of the owner, the court could not have considered, in deciding whether to grant or refuse the injunction, the question raised by the defendant as to the balance of convenience, or of advantage or disadvantage to the plaintiff and defendant, and the public at large, for the defendant's use of the stream. That question would be pertinent only in an application addressed to the legislature to give such corporations that power of condemnation.

See also the case of Grand Rapids Booming Co. *v.* Jarvis (30 Mich. 308), where an overflow of plaintiff's land was held to be a taking of property. These cases are, of course, strictly within the rule as established by the United States Supreme Court. But there are a number of decisions in the several States that go further than the Federal decisions.

Thus, in Grey ex rel. Simmons *v.* Paterson (60 N. J. Equity (15 Dick.) 385, at p. 391) the Court of Errors and Appeals of New Jersey said:

> Riparian owners above tide own ad medium filum aquae, and have a property right in the water flowing along and over their land.

This property right can not be impaired except by the lawful use of the waters by riparian owners higher up the stream.

Lower owners must submit to such pollution as results from the natural or reasonable use of the owners above, produced by the surface drainage or by the percolation of offensive matter through the soil.

But the higher owners can not lawfully combine and by construction of artificial conduits collect foul matter and pour it in mass into the stream. Such a scheme when put into operation constitutes the taking of private property which the legislature can not authorize except upon just compensation to the party injured. (Citing with approval Beach *v.* Sterling Iron and Zinc. Co., 9 Dick. Ch. Rep. 65, approved 10 Dick. Ch. Rep. 824; East Jersey Water Co. *v.* Bigelow, 31 Vr. 201.)

It will be noted that this opinion construes a constitutional provision requiring compensation to be made for the "taking" of property only. The provision is article 1, section 16, of the constitution of the State of New Jersey:

Private property shall not be taken for public use without just compensation.

In Connecticut the constitutional provision is (art. 1, sec. 11):

The property of no person shall be taken for public use without just compensation therefor.

In Nolan *v.* New Britain (69 Conn. 668), decided 1891, the defendant city discharged into a stream, known as Pipers Brook, "large quantities of acids, impure matter, sewage, and other noxious and impure substances," rendering the waters filthy, noxious, and unclean and depriving the plaintiff, a farmer, "of all use of the waters of said brook for watering his stock and for all domestic purposes," injuring the land for agricultural and pasturing purposes, injuring the plaintiff in his business of selling milk, and depriving him of the use of the brook for ice.

This was held by the Connecticut Supreme Court to be a taking of the plaintiff's property within the meaning of the constitution. The court said:

The right of the plaintiff to have the water of Pipers Brook flow through his land as it has been accustomed to flow (i. e., pure and uncontaminated) "is not an easement or appurtenance; but it is inseparably annexed to the soil." (Wadsworth *v.* Tillotson, 15 Conn. 366, 373.) To deprive the plaintiff of that part of his soil for the purposes named in that act, would be the taking of private property for public use, and the plaintiff would be entitled to have just compensation.

And again in the case of Platt Bros. & Co. *v.* Waterbury (72 Conn. 531), where the plaintiffs were owners of a manufacturing establishment, dwelling houses, and other buildings on the Naugatuck River, 2 miles below the defendant city, and sued and recovered damages and an injunction against the city discharging sewage into the stream, previous discharge having been such as to deprive the plaintiffs of

all use of the water of the river except for the purpose of furnishing power and having created such a nuisance that the employees left the plaintiffs' works, etc., the court said:

The injury described by the complaint is not a mere consequential damage, like that resulting wholly from the lawful use of one's own property, or the lawful exercise of governmental power; it is a direct appropriation of well-recognized property rights with the guaranty of the constitution, "The property of no person shall be taken for public use without just compensation therefor." (Citing Nolan *v.* New Britain, supra.)

And in Donnell *v.* Greensboro (164 N. C. 330, 80 S. E. 377), where the sewerage system of the defendant city created a nuisance to the injury of the plaintiff, who sued for an injunction and damages, it was held—

* * * That the damage arising from the impaired value of the property is to be considered and dealt with to that extent as a "taking or appropriation," and brings the claim within the constitutional principle that a man's property may not be taken from him even for the public benefit except upon compensation duly made. This decision, announced in Little *v.* Lenoir (151 N. C. 415), in an opinion by Associate Justice Manning, was reaffirmed and applied in the more recent cases of Moser *v.* Burlington (162 N. C. 141), Hines *v.* Rocky Mount (162 N. C. 409), and is sustained, we think, by the great weight of authority in the country. (Winchell *v.* Waukesha, 110 Wis. 101; Bohan *v.* Port Jervis, 122 N. Y. 18; Joplin Mfg. Co. *v.* City of Joplin, 124 Mo. 120; Village of Dwight *v.* Hayes, 150 Ill. 273; Markwardt *v.* City of Guthrie, 18 Okla. 32; Platt *v.* Waterbury, 72 Conn. 531.)

In Michigan the constitutional provision is (art. 13, sec. 1):

Private property shall not be taken by the public or by any corporation for public use without the necessity therefor being first determined and just compensation therefor being first made or secured in such a manner as shall be prescribed by law.

While it was not necessary to the decision of the case, the following language of Mr. Justice Stone of the Supreme Court of Michigan indicates the view of an eminent jurist to the effect that the unreasonable pollution of a stream constitutes a taking:

Undoubtedly the city has the right to make a reasonable use of the waters of the river as a riparian owner. But the court's attention has not been called to any statute giving the city the right to use Grand River below its limits as a sewer for the purpose of carrying away its waste and refuse in an unreasonable manner; and, if it were attempted by statute to give such a right, the statute would be unconstitutional, unless it first provided that the owners of property along the river should be compensated for damages to be first determined by constitutional methods for destruction of such property rights. (Attorney General *v.* City of Grand Rapids et al., 175 Mich. 503, 141 N. W. Rep. 890, 50 L. R. A. (N. S.) 473, Am. & Eng. Ann. Cas. 1915 A 968.)

A number of States, however, have constitutional provisions requiring compensation to be made not only for the taking, but for the damaging of private property for public purposes. Such is the lan-

guage of the constitution of Arizona, article 2, section 17; Arkansas, article 2, section 22; California, article 1, section 14; Georgia, article 1, section 3, paragraph 1; Minnesota, article 1, section 13; Mississippi, article 3, section 17; Missouri, article 2, section 21; Montana, article 3, section 14; Nebraska, article 1, section 21; New Mexico, article 2, section 20; Oklahoma, article 2, section 24; South Dakota, article 6, section 13; Texas, article 1, section 17; Utah, article 1, section 22; Virginia, article 4, section 58; Washington, article 1, section 16; West Virginia, article 3, section 9, and Wyoming, article 1, section 33.

It is, of course, apparent that in each State that has added to its constitutional provision against the taking without compensation the words prohibiting likewise the damaging of property without compensation, the scope of the provision is greatly enlarged. Indeed, it would seem that the use of this broader language must remove all doubt as to the necessity for compensation for serious injury to riparian owners caused by the pollution of a stream under legislative authority.

In the case of Joplin Mining Co. *v.* City of Joplin (124 Mo. 129), decided 1894, the mining company sued for an injunction against the building of a sewer, which, it was claimed, would pollute a stream upon which the plaintiff was a lower riparian proprietor. The defendant contended that it could not be enjoined because it was authorized by law to lay a sewer.

The court said:

> Section 1541, Revised Statutes, 1879, provides: "Public sewers shall be established along the principal courses of drainage at such times, to such extent, of such dimensions, and under such regulations as may be provided by ordinance." And other sections give the city ample power to condemn private property for sewer purposes, the compensation to be ascertained by five freeholders to be appointed by the mayor. (Secs. 1524 and 1544.) The fair, and, we think, clear, implication of the language used in section 1541 is that the principal courses of drainage may be used for sewer purposes until sewers are constructed along the same. Indeed, these courses of drainage constitute the only receptacles for such matter. We, therefore, hold that the city of Joplin has the right and power to construct the public sewer in question so that it will discharge its contents into Joplin Creek. Whether the city can do this so as to create a public nuisance we need not inquire, for in our opinion the evidence makes out no such a case. It does, however, tend to show that the plaintiff's lands will be damaged by the discharge of the sewer matter into the creek. Whether this damage would amount to the taking of private property for public use is not important to inquire, for our constitution declares that private property shall not be taken or damaged without just compensation. If the discharge of the sewer matter into the creek will decrease the value of the plaintiff's land through which the creek runs, then the damage thus done is clearly within the constitutional provision, and the plaintiff must have compensation therefor. (Van De Vere *v.* Kansas City, 107 Mo. 84.)

And in the later case of Smith *v.* Sedalia (152 Mo. 283, 302, 303) the supreme court said:

> The fact that sewers are necessary to a city and that the statute directs that they shall follow as nearly as practicble the natural drainage of the country, afford no justification to the action of a city in emptying its sewers on the land of an individual to his damage. Our constitution declares that private property shall not be taken or damaged without payment of just compensation. The legislature therefore could not, if it so intended, confer authority on a city to injure private property for the public good without first paying the damage. But subject to this qualification, private interest must yield to the public good. If it is a public necessity that the plaintiff's land be taken or damaged in order to dispose of the sewage of the defendant city, it may be so condemned according to law, but the city must first pay him the just compensation. Such condemnation can only be made in conformity to a proceeding prescribed by statute. The issues in this case do not call for an examination of the statute to ascertain whether or not provision has already been made for the condemnation of land outside the city limits for such purpose, but it is sufficient to say that until such provision is made, if it has not been, and until condemnation has been adjudged in accordance with such provision, or the city has by contract or prescription acquired the right to do so, it is liable for the damage caused by emptying its sewers into a natural stream flowing through private property. (Cooley on Torts, 2 ed. p. 693; Joplin Consolidated Mining Co. *v.* Joplin, 124 Mo. 129.)

But some of the States having a constitutional provision in substantially the same language as the Federal provision appear to take the position taken by the United States Supreme Court, namely, that to constitute a taking there must be practically a deprivation of all beneficial use and that a mere nuisance can not constitute a taking of property.

Thus in Valparaiso *v.* Hagen (153 Ind. 337) the Supreme Court of Indiana held that there was no taking of the plaintiff's property even though the discharge of sewage into the stream by the defendant city caused an overflow of the stream upon plaintiff's land so that the grass upon its premises was rendered worthless. This, the court held, was merely a lessening of the value of the estate and not a taking of property.

And in Ohio in the case of Salem Iron Co. *v.* Hyland et al. it was held that where plaintiff, a manufacturer, was apparently forced to abandon the stream entirely and seek the water supply for his boilers elsewhere, this was no taking of property, but only a nuisance. The court said:

> That an injury to a property right of this character can not be legalized by the legislature does not affect the form of relief which should be awarded on account of an invasion of the right.

This language, used by the court in giving its reason for denial of the injunction, would indicate that the court would not recognize

the right of the legislature to grant immunity from liability to any municipality causing similar injury to a lower proprietor.

Indeed in the case of City of Mansfield *v.* Balliett (65 Ohio St. 451) the court had expressly held that the legislature could not authorize the discharge of sewage in such a way as to create a nuisance.

And the Supreme Court of Massachusetts does not hold municipalities liable for such injuries on constitutional grounds, but would probably place the same limitations upon the doctrine as does the United States Supreme Court. (See Diamond *v.* North Attleborough, 219 Mass. 587.)

BY THE GREAT WEIGHT OF AUTHORITY STATUTES WILL NOT BE CONSTRUED AS AUTHORIZING MUNICIPALITIES TO CREATE NUISANCES BY THE DISCHARGE OF SEWAGE, EVEN IN THOSE JURISDICTIONS WHERE THE CONSTITUTIONAL INHIBITION DOES NOT OBTAIN.

Statutes seldom or never attempt to expressly authorize the creation of a nuisance.

Of course, where the constitutional limitation is recognized it is a complete bar, and leaves no room for so construing the statute as to authorize a nuisance.

In the absence of the constitutional limitation the question becomes entirely one of construction, and by overwhelming weight of authority it is held that the fact that a municipality is authorized to install and operate a sewerage system is no reason for supposing that there was a legislative intent to authorize injury to lower proprietors. This rule is abundantly recognized and of long standing. It had its origin in England where the entire question is one of statutory construction, there being, of course, no constitutional limitations at all.

For example, in Goldsmid *v.* Tunbridge Wells Improvement Commissioners (L. R. 1 Ch. 349):

> The defendants were commissioners for the improvement of Tunbridge Wells under a local act of the 9 and 10 Victoria, which gave full power to drain the town, to make sewers, and to turn any drain or sewer into a common ditch or watercourse.
>
> In the execution of the powers of their act the defendants drained the greater part of the town into a brook called Calverley Brook, which afterwards passed through the plaintiff's estate and supplied the water of an ornamental lake in his park. * * * For the last three or four years as the town increased in size the amount of sewage flowing into the stream greatly increased and the plaintiff complained that the water had become foul and unwholesome.

In upholding the granting of an injunction, the court said:

> There is not, so far as I can find, anything in the provisions of the act of Parliament under which the defendants are acting to authorize them to commit a nuisance upon property beyond the range of their jurisdiction. They

could not possibly, so far as I can see, be justified in discharging the whole of the sewage of Tunbridge Wells bodily upon land not belonging to them and lying immediately beyond the limits to which their powers extend; and if they have no right to do this, neither can they, as it seems to me, have the right to send down the sewage upon an estate which, although nondistant, would be prejudicially affected by it.

See also—

Attorney General *v.* Cockmouth Local Board, L. R. A. Eq. 172.
Attorney General *v.* Leeds, L. R. 5 Ch. 583.

In Winchell *v.* Waukesha (110 Wis. 101, 85 N. W. 668, 84 Am. St. Rep. 902), where the sewage discharged by the defendant city into the Fox River caused offensive and disagreeable odors and rendered the water unfit for bathing and watering stock at the point where it flowed past plaintiff's premises, the Supreme Court of Wisconsin said:

It has been declared by this court in Harper *v.* Milwaukee (30 Wis. 365, 372) that "the general rule of law is that a municipal corporation has no more right to erect and maintain a nuisance than a private individual possesses, and an action may be maintained against such corporation for injuries occasioned by a nuisance for which it is responsible in any case in which, under like circumstances, an action could be maintained against an individual." Again, in Hughes *v.* Fon du Lac (73 Wis. 380, 41 N. W. 407), it is said: "A municipal corporation is no more exempt from liability in case it creates a nuisance, either public or private, than an individual.

The court then took up the contention of the defendant that the doctrine of those earlier cases had been modified by later decisions in other States and that the city was immune from liability because in discharging the sewage into the stream along the line of natural drainage it was but performing a governmental function under the general legislative authority given to municipalities to construct sewer systems, and that the damage resulting was consequential and not actionable. But the court denied that such general authority could be construed as granting any such immunity. Said the court:

When, if ever, the legislature shall enact that streams generally, or any streams, shall be used as sewers without liability to the owners of the soil through which they run, the question of constitutional protection to private rights may be forced upon the courts for decision. Until such enactment is made, however, in clear and unambiguous terms, we shall be slow to hold by inference or implication that it has been made at all. The right of the riparian owner to the natural flow of water substantially unimpaired in volume and purity is one of great value, and which the law has nowhere more persistently recognized and jealously protected than in Wisconsin. Not alone the strictly private right, but important public interests, would be seriously jeopardized by promiscuous pollution of our streams and lakes. Considerations of esthetic attractiveness, industrial utility, and public health and comfort are involved. Amid this conflict of important rights, we can not believe that the legislature concealed, in words merely authorizing municipalities to raise and expend money for the construction of sewers, a declaration of policy that each munici-

pality might, in its discretion, without liability to individuals, take practical possession of the nearest stream as a vehicle for the transportation of its sewage in crude and deleterious condition.

In City of Mansfield *v.* Balliett (65 Ohio St. 451), although the opinion allows relief principally upon the ground that the injury should be construed as an invasion of the defendant's property in a manner forbidden by the constitution of the State, yet says:

There is a line of authorities which sustain the right of action in cases like the one before us, and place it upon the ground that such acts as those complained of here constitute a nuisance, which municipal corporations can not, any more than individuals, be allowed to create or maintain—

and cited a number of authorities and continued:

The right of the plaintiff to the relief awarded him by the judgments of the lower courts is sustained by the case of Rhodes *v.* City of Cleveland (10 Ohio, 160). That suit was brought against the city to recover damages for so cutting its drains as to cause the water to overflow and wash away the plaintiff's lands. The trial court charged the jury that the plaintiff could not recover "unless he showed either that the city acted illegally or, if within the scope of authority, that they acted maliciously." In reversing the judgment founded on the verdict for the defendant, this court held that "corporations are liable like individuals for injuries done, although the act was not beyond their lawful powers." The grounds of the decision are stated in the opinion by Lane, C. J., as follows: "That the rights of one should be so used as not to impair the rights of another is a principle of morals which, from very remote ages, has been recognized as a maxim of law. If an individual, exercising his lawful powers, commit an injury, the action on the case is the familiar remedy; if a corporation, acting within the scope of its authority, should work wrong to another, the same principle of ethics demands of them to repair it, and no reason occurs to the court why the same remedy should not be applied to compel justice from them."

That decision is founded upon the broad principles of common justice and constitutional right. It is applicable to and decisive of this case * * *.

The case of Carmichael *v.* City of Texarkana (94 Fed. Rep. 561) is another case in which it is held that legislative authority to construct sewers can not be construed as authorizing the creation of a nuisance.

The case of Markwardt *v.* City of Guthrie (18 Okla. 32) is one in which a number of cases are carefully reviewed, and it is held that legislative authority to construct a sewerage system did not authorize the defendant city to pollute the stream to the injury of the plaintiff. While the constitutional question was discussed at some length, the holding appears to be based rather upon the same reasoning as was adopted in Winchell *v.* Waukesha, namely, that there can be no implied authority to create a nuisance. The opinion indicates, however, that the court would probably deny the power to authorize a nuisance if the legislature should attempt it.

In the case of Jones et al. *v.* Sewer District No. 3 et al. (177 S. W. 888), decided June 17, 1915, condemnation proceedings had been had under legislative authority and property had been condemned and rights taken for the purpose of installing and maintaining a sewerage system and septic tank to purify and discharge the sewage of the city of Rogers. The effluent from the disposal works was discharged into a watercourse which flowed through the lands of the plaintiff, who alleged that a nuisance resulted, and brought suit for an injunction. The contention of the plaintiff was sustained, the court holding that the statutory authority, and even the condemnation proceedings pursuant thereto, must be construed as having established the right only to operate the system in a proper manner and that they were still liable for the creation of a nuisance.

The Supreme Court of Indiana has taken the opposite position. In the case of City of Valparaiso *v.* Hagen (153 Ind. 337) where the lower court had granted an injunction against the defendant city, prohibiting its discharge of sewage into Salt Creek, the case was reversed by the supreme court upon the ground that the legislature, having conferred upon municipalities the power to construct sewers and outlets, "the granting of such powers imposes the duty to exercise them in all needful cases," and further that—

* * * There is no pretense that there is any other possible outlet or practical means of disposing of sewage, or that the sewer was unskillfully or negligently constructed.

Hence, then, to forbid a discharge of sewage into Salt Creek is to deny to the city the right to discharge it anywhere, and thus leave it without the ordinary means of sanitation. Surely it is not the law that a salutary statute, essential to the health and welfare of the public, may be thus nullified by exhibiting a damage to private right. The sewage must be dispatched or the city abandoned. The place adopted for the outpour is that provided by nature and can not be had elsewhere. The facts present a case wherein the principle of the greatest good to the greatest number must be permitted to operate, and private interest yield to the public good, and if the erection has been skillfully performed, and without negligence, as is shown to be the fact by the record, and in a way to do the least[1] mischief, it must be held to be a lawful exercise of power that equity will not restrain. (Barnard *v.* Sherley, 135 Ind. 547, 24 L. R. A. 568; City of Richmond *v.* Test, 18 Ind. App. 482, 501; Merrifield *v.* City of Worcester, 110 Mass. 216.)

And it was held that there was no taking of private property even though the stream was caused to overflow with the result that the grass upon the premises of the appellee was rendered worthless. This, the court held, was merely a lessening of the value of the estate and not a taking of property.

It will not do to say that the stream and appellees' land lying along the margins of Salt Creek should have been condemned by the city to the right to dispatch sewage along the stream before proceeding to do so. According to the statement of appellant's counsel the premises of appellees, alleged to be af-

[1] Decision reads "best."

fected, are situated from 2 to 10 miles by the stream from the corporate limits of the city; and, if the city is required to go so far to recompense sewage effect, "where may it stop short of the sea?" Appellant had lawful authority to exercise the right of eminent domain in securing an outlet for its sewage, but no such authority exists as will permit it to seize upon the stream and its margins to relieve consequential damages. (City of Richmond *v.* Test, 18 Ind. App. 482, 500, and authorities cited.)

Of the judgment of the lower court, the supreme court said:

The judgment is anomalous, in that it expressly authorizes appellant to construct the proposed extension through the marsh to Salt Creek, but forbids forever the pollution of the waters of the stream.

It is apparent that in this case, which was decided in 1899, the record did not contain proof that the difficulty presented could be overcome by the adoption of purification methods. The opinion clearly indicates that in the view of the court no such alternative is open to the city, but that either the nuisance to the plaintiff must be continued or that the city must suffer severely from a sanitary point of view "or the city" be "abandoned."

And to the same effect is the City of Richmond *v.* Test (18 Ind. App. 482). There the city of Richmond discharged its sewage into Whitewater River and caused serious damage to the plaintiff, who was a proprietor of a woolen factory, a mile south of the city, and it was held that inasmuch as the city was authorized by law to construct sewers, the injury, of which the plaintiff complained, was only a consequential damage resulting from the proper exercise of a governmental function and that there was no liability on the part of the city.

But the Supreme Court of Indiana has displayed a very strong disposition to depart from the doctrine in these cases. In the case of Penn American Plate Glass Co. *v.* Schwinn (177 Ind. 645, 98 N. E. 715), decided May 28, 1912, the following language is used:

There is, perhaps, one line of distinction, which in the opinion of the writer of this opinion, is unsound, and that is an exception in favor of cities making avail of streams for sewerage without liability. That doctrine grew up from a supposed necessity; but the same reasons which seemed to be grounds for the exception to the rule in regard to the pollution of streams by cities are the very ones which must sooner or later reverse it. It is a matter of common knowledge everywhere, and the subject of recent legislation in this State, that the streams of pure and limpid water, which formerly traversed the State, have become cesspools of filth and breeders of disease and polluted to nausea; and we must certainly, and the sooner the better for the State and its inhabitants, take steps necessary to the removal of sewage from our streams and their restoration to their natural condition; and certainly such exception as now applies to cities should never be extended to manufacturing or commercial enterprises, if it be retained as to the cities. Two marked cases of the excepted class are City of Valparaiso *v.* Hagen (1898, 153 Ind. 337) and the cases upon which it is based, recognized in Weston Paper Co. *v.* Pope (155 Ind. 400) and City of Richmond *v.* Test (1897, 18 Ind. App. 482), both of which are, in the opinion of the writer, based upon unsound premises. They

are grounded upon the supposed necessity of the rule, following the Sanderson case in Pennsylvania and Barnard *v.* Sherley (185 Ind. 547, 24 L. R. A. 568). The rule of necessity thus disclosed must, in and of itself, inevitably force just the opposite doctrine in the interest of the public health, the very thing supposed to be subserved by the rule, when it is daily becoming more and more apparent that the sewage into the streams is a real nuisance to the public health, and it is not a necessity, because it can be otherwise provided for with practicability and assured safety to the public health.

Far preferable and more consistent, both with private rights and the public interest, that the streams shall be preserved without contamination, and as arteries adequate to carry the floods of water continually increasing in quantity and velocity by reason of the agricultural drainage precipitating them quickly into streams and that no supposed rule of necessity in order to the carrying on of a business, on account of its usefulness or necessity, or that it can not be carried on without producing these results, nor the fact of skill and care to prevent it, or on account of the amount involved, can be allowed as an exception, nor can the riparian owner below be required to protect himself; the right is an incident of the title, and such is the law of this State.

And the holding in Valparaiso *v.* Hagen and in City of Richmond *v.* Test has also been noticed and criticized by the courts of a number of other States—for example, in Winchell *v.* Waukesha (110 Wis. 101, 85 N. W. 668, 84 Am. St. Rep. 902), where it was said:

The right of the riparian owner to the natural flow of water substantially unimpaired in volume and purity is one of great value, and which the law has nowhere more persistently recognized and jealously protected than in Wisconsin. Not alone the strictly private right, but important public interests, would be seriously jeopardized by promiscuous pollution of our streams and lakes. Considerations of æsthetic attractiveness, industrial utility, and public health and comfort are involved. Amid this conflict of important rights, we can not believe that the legislature concealed, in words merely authorizing municipalities to raise and expend money for the construction of sewers, a declaration of policy that each municipality might, in its discretion, without liability to individuals, take practical possession of the nearest stream as a vehicle for the transportation of its sewage in crude and deleterious condition. At that stage in its logic we can not agree with the Indiana court in Valparaiso *v.* Hagen (153 Ind. 337). The authority granted to municipalities is to construct sewers, but subject to the general legal restrictions resting upon such corporations forbidding invasion of private rights by creation of nuisance or otherwise. This view of the legislative purpose is enforced by the consideration that, although liquid sewage must flow off along the general drainage courses of the vicinity, it is by no means physically necessary that it should carry with it the solids in an offensive or unhygienic condition. (Hackstack *v.* Keshina Imp. Co. 66 Wis. 439, 29 N. W. 240.) It is a matter of common knowledge and of proof in this case that there are practical methods for the decomposition and practical destruction of such solids before delivering them into open watercourses; the most modern method, as explained in septic bacteria tanks, whereby the decomposition and resolution into offensive and innocuous fluids, gas, and mineral solids is greatly expedited * * *.

And in Platt Bros. & Co. *v.* Waterbury (72 Conn. 531) it was said:

The theory of the defendant that the necessities of a city may not only justify the taking of riparian rights but the taking without compensation, seems

to find support in some Indian cases. (Richmond v. Test, 18 Ind. App. 462; Barnard v. Sherley, 135 Ind. 547; Valparaiso v. Hagen, 153 id. 337.) We do not find other cases that take this extreme ground. The right to compensation can not be questioned in this State.

While it is quite probable that the Indiana courts would hesitate to reverse the holding that the pollution of a stream by a municipality, even to the extent of causing serious injury to the lower riparian proprietor, would constitute a taking of property, yet it is believed that the expressions found in the later cases would indicate that municipalities would be held liable upon the ground of nuisance, wherever such damage was caused as a result of a failure to adopt scientific and effective methods of purification.

The Massachusetts Supreme Court appears to take the view that the legislature has power to permit the discharge of sewage into streams even to the extent of creating a nuisance, but that statutes will not be construed as giving such power unless a necessary result of the exercise of that power would be the creation of a nuisance; that is to say, all presumption is against the intent of the legislature to permit the creation of a nuisance by the same, but, on the other hand, if it gives to the city a power that can not be exercised without the creation of a nuisance, then the power is to be upheld and the nuisance permitted.

In Morse v. City of Worcester (139 Mass. 390), the court said:

In the case at bar, the legislature authorized the city of Worcester to use Mill Brook as a sewer; by necessary implication, the statute authorized it to empty its sewage into Blackstone River; but we can not presume that it was the intention of the legislature to exempt the city from the obligation to use due care in the construction and management of its works, so as not to cause any unnecessarily injurious consequences to the rights of others. If it is practicable to use any methods of constructing the sewer, and, as a part of the construction, of purifying the sewage at its mouth, at an expense which is reasonable, having regard to the nature of the work and the magnitude and importance of the interests involved, it is the duty of the city to adopt such methods.

The case comes before us in such a form that we can do no more than state the general principles which must govern the hearing. The bill alleges negligence in constructing the sewer, and in failing to use reasonable precautions in purifying the sewage. We can not anticipate what negligence may be proved. Negligence in this, as in most other cases, is largely a question of degree. If the plaintiff shows that, in constructing the sewer, as in adopting the brook to its use as a sewer, the defendant did the work in an improper manner, the bill can be maintained. So, if he proves that the defendant, in constructing the sewer, could have adopted, at an expense which is reasonable, a system of cesspools, or some other methods of purification, at the mouth of the brook, it may be that his bill can be maintained. We can not say in advance that some such method may not be practicable, and within the duty of the defendant to use reasonable precautions in doing the work authorized by the statute to prevent a nuisance. This is a question of fact. The allegations of the bill are so broad that the demurrer can not be sustained. The

question whether, upon the existing facts and conditions, the defendant has been guilty of any negligence, can not be determined until such facts are developed by the evidence at the hearing.

This is all that is necessary for the decision of this case. But, to prevent misunderstanding we add that if the only mode of preventing the pollution of the river is found to be by the adoption of an extensive system of purification, independent of the construction of the sewer, requiring the taking of large tracts of land, we must not be understood as implying that it is within the duty or the power of the defendant to do this.

The power to convert the brook into a sewer carries, by implication, the power to expend money for any plan of work which is an incident or part of the main work authorized by the statute, but it would seem that the statute does not give the defendant power to take lands or expend money for an independent system of sewage purification. If such system is rendered necessary by the construction of the sewer, the remedy must be sought from the legislature, which can best adjust and settle the conflicting rights and interests of the public, and of the riparian owners upon the rivers.

In Moody *v.* Village of Saratoga Springs (17 App. Div. (N. Y.) 207) plaintiff brought suit for an injunction to restrain the defendant city from discharging sewage into the Kayaderosseras Creek, near the plaintiff's home, causing the stream and air to become polluted to the plaintiff's injury. Damages were also asked. Plaintiff was awarded an injunction and also damages. The judgment was sustained by the appellate division. The injury to the plaintiff was admitted, but the defendant city denied liability upon the ground that chapter 149 of the laws of 1885 authorized commissioners to extend the main sewer of the village to a new terminus to be selected by the commissioners, and that such extension has been made by the commissioners with the result that the sewage was thereafter discharged into the creek near the plaintiff's premises producing the nuisance complained of. It was contended that this extension of the sewer was the act of the State and not of the village, and that the latter could not, therefore, be liable, but the court held otherwise. It was conceded that had the statute been enacted to effect some purpose beneficial to the State generally and "foreign to any corporate purpose or special benefit to the village of Saratoga Springs or its people, the State, and not the village, should be answerable for the resulting nuisance to the plaintiff."

But (said the court) it is made a part of the corporate duty of the village of Saratoga Springs, by various acts, to provide and maintain a system of sewers, and this act of 1885, by its third section, while it authorizes the commissioners "to construct an extension of the main sewer in such manner as they shall deem expedient," significantly adds the words, "and for the interests of the village of Saratoga Springs." Other parts of the act indicate that the purpose of the sewer extension was to promote such interests, and the nature of the case imports such a purpose.

Moreover, the village has adopted the extension which the act commits to its care and custody. This is the fair inference from the evidence.

For the six years following the extension the village had used this extension and permitted its sewage to be conveyed by it and discharged into the creek near the plaintiff's house and premises. Within the doctrine of the above cases and others, the village is liable. (N. Y. Central & H. R. R. R. Co. *v.* City of Rochester, 127 N. Y. 591; Stoddard *v.* Village of Saratoga Springs, id. 261; Chapman *v.* City of Rochester, 110 id. 273; Noonan *v.* City of Albany, 79 id. 470; Bolton *v.* Village of New Rochelle, 84 Hun, 281.)

The defendant urges that, as the extension was authorized by the act and was not negligently or unskillfully executed, the defendant is not liable. The plaintiff does not complain of the construction but of the use which is made of it to his injury. The act authorizing the extension undoubtedly authorizes its use, but not such use as results in a nuisance. (Seifert *v.* City of Brooklyn, 101 N. Y. 136; N. Y. C. & H. R. R. R. Co. *v.* City of Rochester, supra; Hooker *v.* City of Rochester, 37 Hun, 181; affirmed, 107 N. Y. 676.)

Assuming the lawfulness of the construction and the right to its use, the use, as was said in Booth *v.* R., W. & O. T. R. R. Co. (140 N. Y. 267, 275), after commenting upon many cases, must not be to the injury of any legal rights of another. The plaintiff's legal right to air and water in the purity that existed before the defendant polluted them by sewage can not be questioned. If the defendant by any right of eminent domain can take the right from the plaintiff, it must do so upon making just compensation.

The judgment should be affirmed, with costs.

TABLE OF CASES.

Page.

Alabama Consolidated Coal & Iron Co. *v.* Turner 68
Albany, Noonan *v* 84, 132
Alden, Serley *v* 53
Alger, Comm. *v* 89, 92, 100, 106
Allard, Jacobs *v* 27, 28
Allen, Pennoyer *v* 43
Alta Land Co. *v.* Hancock 77
Altoona, Good *v* 52
American Strawboard Co., Indianapolis Water Co. *v* 22, 23, 42, 48, 58, 61
American Woolen Mills Co., Parker *v* 18, 31, 48, 51, 58, 62, 63
Anchor Brewing Co. *v.* Dobbs Ferry 81
Anderson, Senior *v* 53
Andrew, Canfield *v* 59, 66
Anthony, Handly *v* 103
Apalache, Mason *v* 36, 119
Arlington Mills Co., Jackman *v* 15, 48, 80
Arndt, Shields *v* 57
Atkin *v.* Kansas 93
Atlantic De Laine Co., Richmond Mfg. Co. *v* 23, 25, 58
Attorney General *v.* Birmingham, Tame & Rea District Drainage Board 112
Attorney General *v.* Cockmouth Local Board 125
Attorney General *v.* Grand Rapids 68, 70, 71, 74, 78, 79, 121
Attorney General *v.* Jamaica Pond Aqueduct Corpn 67
Attorney General *v.* Leeds 125
Attorney General *v.* Richmond 71
Auburn Gas Light Co., Carhart *v* 58
Aurora, Walker *v* 111
Bailey *v.* N. H. & N. Co 45
Bainard *v.* Newton 79
Baker, Crabtree *v* 68
Balliett, Mansfield *v* 124, 126
Balto. & P. R. Co. *v.* Fifth Baptist Church 42, 43
Baltimore, Boehm *v* 94
Baltimore, Deems *v* 94
Baltimore *v.* Warren Mfg. Co 10, 48
Bankier Distillery Co., Young *v* 33, 34
Bank of Columbia, Renner *v* 45
Barber, Minnesota *v* 93
Barclay *v.* Comm 76
Bard *v.* Yohn 54
Bargus, State *v* 103
Barnard *v.* Shirley 41, 127, 129, 130
Barnstable, Hinckley *v* 45
Barton *v.* Union Cattle Co 14, 28, 31, 42, 59

Page.
Baxendale *v.* McMurray 59, 70
Beach *v.* Sterling Iron & Zinc Co 14, 32, 34, 47, 58, 67, 120
Bealey *v.* Shaw 70
Beidler *v.* Sanitary District 9
Belknap *v.* Trimble 66
Bigelow, East Jersey Water Co. *v.* 120
Birmingham, Tame & Rea District Drainage Board, Attorney General *v.* 112
Blackburne *v.* Somers 71
Blaisdell *v.* Stephens 55, 59
Blum, New York *v.* 11, 14, 96, 112
Blunt *v.* Hay 60
Board of Health, Miles City *v.* 95, 100, 108
Boehm *v.* Balto 94
Bohan *v.* Port Jervis 121
Boiling Springs Bleaching Co., Holsman *v.* 9, 24, 57, 58, 63, 66
Bolton *v.* New Rochelle 132
Bonte *v.* Postel 54
Booth *v.* R. W. & O. T. R. R. Co 132
Booth *v.* Shepherd 103
Boston Disinfecting Co., Train *v.* 115
Boston Duck Co., Gould *v.* 44
Boston Rolling Mills *v.* Cambridge 71
Bowen *v.* Wendt 71
Bowling Coal Co. *v.* Ruffner 11, 32, 52
Bowman *v.* Humphrey 54
Boyce's Exrs. *v.* Grundy 66
Boyd *v.* Granite Co 36
Boyd *v.* Schreiner 61
Boyle, Foreman *v.* 52, 53
Bragg, Crocker *v.* 62
Brinsop Hall Coal Co., Pennington *v.* 48
Briston, Mansfield *v.* 56
Broadbelt, State *v.* 94
Brockney, Thomas *v.* 52, 62
Brodbine *v.* Revere 115
Bromly, Woodbury *v.* 80
Brookline *v.* Mackintosh 18, 95
Brooklyn, Mills *v.* 81
Brooklyn, Seifert *v.* 132
Brown, Cadigan *v.* 66
Brown, Draper *v.* 55
Brown *v.* Gold Coin Mining Co 26
Brumfitt, Thorpe *v.* 59
Buccleugh *v.* Coman 59
Bunker Hill & Sullivan Mining & Coal Co., McCarthy *v.* 40
Burden, Stein *v.* 68
Burlington, Moser *v.* 121
Bush *v.* Western 57
Butte City Water Co., Talbott *v.* 101
Butte *v.* Paltrovich 101
Cadigan *v.* Brown 66
Cambridge, Boston Rolling Mills *v.* 71
Campbell *v.* Seaman 67

Page.
Canandaigua Gas Light Co., Cartwright *v.* 109
Canfield *v.* Andrew 59, 66
Carhart *v.* Auburn Gaslight Co 58
Carmichael *v.* Texarkana 126
Carnegie, Lentz *v.* 42
Carnegie, Robb *v.* 34, 42
Cartwright *v.* Canadaigua Gas Light Co 109
Case, Hazeltine *v.* 86
Catonsville Water Co., Helfrich *v.* 12, 14, 44, 87, 95, 96
Champaign Co. *v.* Church 94
Chapman *v.* Rochester 52, 73, 75, 79, 132
C. H. & D. R. Co. *v.* Sullivan 94
C. H. & D. Ry. Co. *v.* Troy 94
Chester, George *v.* 111
Chipman *v.* Palmer 48, 53, 55, 59
Church, Champaign Co. *v.* 94
Cincinnati, Sandusky & Cleveland R. Co. *v.* Cook 94
Cincinnati *v.* Steinkamp 103
Clark *v.* Penna. R. R. Co 62
Clark *v.* Stewart 66
Cleveland *v.* N. J. Steamboat Co 45
Cleveland, Rhodes *v.* 126
Cleveland *v.* Standard Bag, etc., Co 50
Clifton Iron Co. *v.* Dye 52
Clowes *v.* Staffordshire Potteries Co 66
Coal Co., Stevenson *v.* 25
Cockmouth Local Board, Attorney General *v.* 125
Coe *v.* Winnipiseogee Mfg. Co 66
Coglan, Welch *v.* 94, 116
Colebrook, Patterson *v.* 46
Collerd, McAndrews *v.* 43
Collins *v.* Waltham 80
Columbus & Hocking Coal & Iron Co. *v.* Tucker 34, 45, 51
Columbus Co. *v.* Taylor 32
Coman, Buccleugh *v.* 59
Comm. *v.* Alger 89, 92, 100, 106
Comm., Barclay *v.* 76
Comm. *v.* Jacobson 115
Comm. *v.* McCormick 37
Comm. *v.* Moorehead 101
Comm. *v.* Sisson 95, 99, 100, 115
Comm. *v.* Straight Creek Coal & Coke Co 109
Comm. *v.* Tewksbury 92, 106
Comm. *v.* Upton 71, 111
Concord, Hubbard *v.* 46
Cook, Cincinnati, Sandusky & Cleveland R. Co. *v.* 94
Cook, Portland *v.* 101
Corning *v.* Troy Iron & Nail Factory 62
Cox *v.* Howell 11
Crabtree *v.* Baker 68
Crane *v.* Roselle 80
Cristensen, Crowley *v.* 93
Crocker *v.* Schureman 45

Page.
Crooker *v.* Bragg 62
Crossley *v.* Lightowler 48, 59
Crowley *v.* Cristensen 98
C. S. & C. Ry. Co., L. S. & M. S. Ry. Co. *v.* 94
Cunningham, People *v.* 71
Cutter *v.* Powell 45
Daley *v.* Watertown 81
Davis *v.* Lambertson 57
Day, Dunham *v.* 45
Day *v.* Louisville Coal & Coke Co 18, 54
Débris Case 55
De Donato *v.* Morrison 54
Deems *v.* Balto 94
De Held, Soltan *v.* 66
Dennis *v.* State 49
Diamond *v.* North Attleborough 119, 124
Diamond Mills Paper Co., State Board of Health *v.* 95, 104, 107
Dilworth, Sloggy *v.* 55
Dixon Pure Ice Co., Sandusky Portland Cement Co. *v.* 58
Dobbs Ferry, Anchor Brewing Co. *v.* 81
Dolby *v.* Heist 45
Donk Bros. Coal & Coke Co., Tetherington *v.* 9, 52
Donnell *v.* Greensboro 49, 121
Dorr, Sprague *v.* 90, 99, 100
Drake *v.* Lady Ensley Coal, Iron & Ry. Co 34, 52
Draper *v.* Brown 55
Dresser, Meyer *v.* 45
Dumont *v.* Kellogg 44
Dunham *v.* Day 45
Durham *v.* Eno Cotton Mills 92, 106, 108
Dwight *v.* Hayes 65, 74, 121
Dwinel, Veazie *v.* 71
Dye, Clifton Iron Co. *v.* 52
East Jersey Water Co. *v.* Bigelow 120
Elder *v.* Lykens Valley Coal Co 52
Electric Traction Co., Wiest *v.* 54
Elk River Mill & Lumber Co., People *v.* 78
Elliott *v.* Ferguson 26
Embrey *v.* Owen 62
Emery *v.* Erskine 60
Eno Cotton Mills, Durham *v.* 92, 106, 108
Erskine, Emery *v.* 60
Eufaula Water Co., Ulbricht *v.* 63, 68, 86
Everson, Simmons *v.* 55
Fall River Iron Works Co., Sherman *v.* 48
Fargo, Judd *v.* 45
Ferguson, Elliott *v.* 26
Fich *v.* Resbridger 57
Fifth Baptist Church, Balto. & P. R. Co. *v.* 42, 43
Fisk, Franklin *v.* 82
Fisk, Sewall's Falls Bridge Co. *v.* 45
Flagg *v.* Worcester 80
Flat River Booming Co., Middleton *v.* 60

Page.
Fletcher *v.* Rylands 82
Fond du Lac, Hughes *v* 78, 125
Foreman *v.* Boyle 52, 58
Franklin *v.* Fisk 82
Gage, Webber *v* 66
Gallagher *v.* Kemmerer 54
Gardner *v.* Newburgh 57, 66
Garrett Park, Sprigg *v* 94
Garwood *v.* N. Y. Cent., etc., R. Co 62
Geiger, Prentice *v* 43, 69
Gentsch *v.* State 108
George *v.* Chester 111
Germantown Water Co., McCollum *v* 76
Geurkink *v.* Petaluma 58
Gifford, Reid *v* 60
Gladfelter *v.* Walker 47, 62
Gold Coin Mining Co., Brown *v* 26
Gold Run, etc., Mining Co., People *v* 71
Goldsmid *v.* Tunbridge Wells Improvement Commissioners 68, 70–74, 124
Good *v.* Altoona 52
Gould *v.* Boston Duck Co 44
Grand Rapids, Attorney General *v* 68, 70, 71, 74, 78, 79, 121
Grand Rapids Booming Co. *v.* Jarvis 119
Granite Co., Boyd *v* 36
Green Bay & Miss. Canal Co., Pumpelly *v* 117
Greene *v* Nunemacher 57
Greensboro, Donnell *v* 49, 121
Greenville, State Board of Health *v* 93, 101, 116
Grey *v.* Paterson 77, 119
Griesner, Kauffman *v* 15
Griffin, State *v* 89, 104
Grinnell, Thomas *v* 88
Griswold, Parker *v* 62
Grundy, Boyce's Exrs. *v* 66
Gurry, State *v* 116
Guthrie, Markwardt *v* 75, 121, 126
Hackstack *v.* Keshina Imp. Co 129
Hagen, Valparaiso *v* 123, 127, 128, 129, 130
Haile Gold Mining Co., Williams *v* 36, 119
Hall, Mills *v* 71
Hall, Sellick *v* 55
Hall *v.* Siegel 110
Hamilton, Tenn., Coal, Iron & Coke Co. *v* 18, 35, 49, 52
Hammon *v.* Zahner 62
Hammond, Honsee *v* 11, 46, 52
Hammond, Inglebright *v* 45
Hancock, Alta Land Co. *v* 77
Handly *v.* Anthony 103
Hannibal, Martinowsky *v* 55
Hardy, Holden *v* 93
Harley *v.* Merrill 54
Harper *v.* Milwaukee 78, 125
Harris *v.* Mackintosh 67

Page.
Haupt's Appeal 86
Hay, Blunt *v.* 60
Hay, Murray *v.* 60
Hayes, Dwight *v.* 65, 74, 121
Hays *v.* Waldron 21, 46, 61
Hazeltine *v.* Case 86
Health Department *v.* Rector 101
Heeg *v.* Licht 43
Heist, Dolby *v.* 45
Helena *v.* Kent 101
Helfrich *v.* Catonsville Water Co 12, 14, 44, 87, 95, 96
Henderson *v.* Robinson 71
Herrington, Peck *v.* 80
Hill *v.* Smith 48
Hill *v.* Standard Mining Co 25
Hillman *v.* Newington 50
Hinckley *v.* Barnstable 45
Hines *v.* Lockport 81
Hines *v.* Rocky Mount 121
Holden *v.* Hardy 98
Holsman *v.* Boiling Springs Bleaching Co 9, 24, 57, 58, 63, 66
Honsee *v.* Hammond 11, 46, 52
Hooker *v.* Rochester 132
Horan, McCormick *v.* 15
Hoskell *v.* New Bedford 75
Hover, Straight *v.* 39, 52
Howell, Cox *v.* 11
Howell *v.* McCoy 76
Hubbard *v.* Concord 46
Hughes *v.* Fond du Lac 73, 125
Hughland Ditch Co., Miller *v.* 55
Hulbert, People *v.* 12, 14, 85, 95, 96
Humphrey, Bowman *v.* 54
Hyland, Salem Iron Co. *v.* 29, 41, 123
Hyman, State *v.* 94
Illinois, Missouri *v.* 67
Improvement Co., Lull *v.* 54
Indianapolis Water Co. *v.* American Strawboard Co 22, 23, 42, 48, 58, 61
Inglebright *v.* Hammond 45
Irvine *v.* Wood 55
Jackman *v.* Arlington Mills Co 15, 48, 80
Jacobs *v.* Allard 27, 28
Jacobson, Comm. *v.* 115
Jacobson *v.* Massachusetts 93, 94, 115
Jamaica Pond Aqueduct Corpn., Attorney General *v.* 67
Jarvis, Grand Rapids Booming Co. *v.* 119
Jenkins *v.* Ry 16
Johns *v.* Stevens 62
Jones *v.* Sewer District No. 3 127
Joplin, Joplin Consolidated Mining Co. *v.* 75, 121, 122, 123
Joplin Consolidated Mining Co. *v.* Joplin 75, 121, 122, 123
Judd *v.* Fargo 45
Kansas, Atkin *v.* 93

Page.
Kansas, Mugler *v.* 98
Kansas City, Van De Vere *v.* 122
Kauffman *v.* Griesner 15
Kellogg, Dumont *v.* 44
Kemmerer, Gallagher *v.* 54
Kenoway, Noble *v.* 45
Kent, Helena *v.* 101
Kerr Salt Co., Strobel *v.* 11, 34, 44, 48, 49, 58, 60
Keshina Imp. Co., Hackstack *v.* 129
Kewanee *v.* Otley 9
Kirk, People *v.* 111
Knox, Rideout *v.* 100
Kraver *v.* Smith 69, 71
Krayer, La France *v.* 54
L. & N. R. Co., West *v.* 70
Lady Ensley Coal, Iron & Ry. Co., Drake *v.* 34, 52
Laflin & Rand Powder Co. *v.* Tearney 43
La France *v.* Krayer 54
La Grange, Robb *v.* 80
Lambertson, Davis *v.* 57
Lansing, Scofield *v.* 60
La Pell, People *v.* 118
Lawrence, Lockwood Co. *v.* 21, 24, 55, 58, 59, 60, 62, 65
Leeds, Attorney General *v.* 125
Lenoir, Little *v.* 121
Lentz *v.* Carnegie 42
Lewis *v.* Stein 72, 91, 95
Licht, Heeg *v.* 48
Lightowler, Crossley *v.* 48, 59
Little *v.* Lenoir 121
Little Schuylkill Nav. R. & C. Co. *v.* Richards 54, 55
Littleton *v.* Richardson 45
Livingston *v.* McDonald 83
Lockport, Hines *v.* 81
Locks & Canals *v.* Lowell 75
Lockwood Co. *v.* Lawrence 21, 24, 55, 58, 59, 60, 62, 65
Lombard, Merrifield *v.* 18, 21, 58, 66, 67, 70
Long *v.* Swindell 55
Loomis, Olmstead *v.* 66
Louisville Coal & Coke Co., Day *v.* 18, 54
Lowell, Locks & Canals *v.* 75
L. S. & M. S. Ry. Co. *v.* C. S. & C. Ry Co 94
L. S. & M. S. R. R. Co. *v.* Roach 110
Lull *v.* Improvement Co 54
Lykens Valley Coal Co., Elder *v.* 52
Lynah, United States *v.* 117, 119
Lyon *v.* McLaughlin 58
McAndrews *v.* Collerd 43
McCarthy *v.* Bunker Hill & Sullivan Mining & Coal Co 40
McCollum *v.* Germantown Water Co 76
McCormack, Tiffin *v.* 43
McCormick, Comm. *v.* 87
McCormick *v.* Horan 15

Page.
McCoy, Howell *v.* 76
McCue, Middlesex Co. *v.* 90
McDonald, Livingston *v.* 83
McEvoy *v.* Taylor 13, 17
McGavin, McIntyre *v.* 70
McGill *v.* State 103
McGowan, Mizell *v.* 15
Machias Water Power Co., Morse *v.* 66
McIntyre *v.* McGavin 70
Mackintosh, Brookline *v.* 18, 95
Mackintosh, Harris *v.* 67
McLaughlin, Lyon *v.* 55
McMurray, Baxendale *v.* 59, 70
MacNamara *v.* Taft 19, 51, 59, 61
Manigault *v.* Springs 118, 119
Mann *v.* Retsof Mining Co. 34
Mansfield *v.* Balliett 124, 126
Mansfield *v.* Briston 58
Markwardt *v.* Guthrie 75, 121, 126
Martin *v.* Schwertley 83
Martin, Thurber *v.* 44
Martinowsky *v.* Hannibal 35
Mason *v.* Apalache 36, 119
Massachusetts, Jacobson *v.* 93, 94, 115
Mendota Coal & Coke Co., Packwood *v.* 17
Merrifield *v.* Lombard 18, 21, 58, 66, 67, 70
Merrifield *v.* Worcester 127
Merrill, Harley *v.* 54
Mersereau, Slater *v.* 56
Meyer *v.* Dresser 45
Middlesex Co. *v.* McCue 90
Middlestadt *v.* Waupaca Starch & Potato Co. 24, 58
Middleton *v.* Flat River Booming Co. 60
Miles City *v.* Board of Health 95, 100, 106
Miller *v.* Highland Ditch Co. 55
Miller *v.* Pendleton 45
Mills *v.* Brooklyn 81
Mills *v.* Hall 71
Mills *v.* United States 118
Milwaukee, Harper *v.* 73
Mining Co., Threatt *v.* 36, 119, 125
Mininger *v.* Norwood 68
Minnesota *v.* Barber 98
Mississippi Mills Co. *v.* Smith 36, 42
Missouri *v.* Illinois 67
Mizell *v.* McGowan 15
Moffitt, Valparaiso *v.* 53
Moody *v.* Saratoga Springs 131
Moore *v.* Webb 70
Moore, Wright *v.* 68
Moorehead, Comm. *v.* 101
Morrison, De Donato *v.* 54
Morse *v.* Machias Water Power Co. 66

Page.
Morse, State *v*---- 95
Morse *v.* Worcester---- 130
Moser *v.* Burlington---- 121
Mugler *v.* Kansas---- 93
Murray *v.* Hay---- 60
Nashua, Von Mills *v*---- 75
Nelson *v.* State Board of Health---- 95, 115, 116
New Bedford, Hoskell *v*---- 75
New Britain, Nolan *v*---- 70, 120, 121
Newburgh, Gardner *v*---- 57, 66
Newington, Hillman *v*---- 59
N. J. Steamboat Co., Cleveland *v*---- 45
New Rochelle, Bolton *v*---- 132
Newton, Bainard *v*---- 79
New York *v.* Blum---- 11, 14, 96, 112
New York *v.* Pine---- 39, 41
N. Y. Cent. &c. R. Co., Garwood *v*---- 62
N. Y. Central & H. R. R. R. Co. *v.* Rochester---- 132
N. Y. Central Ry. Co., Waffle *v*---- 14
N. Y. Rubber Co. *v.* Rothery---- 61
N. H. & N. Co., Bailey *v*---- 45
N. N. & M. V. Co. *v.* Wilson---- 17
Noble *v.* Kenoway---- 45
Nolan *v.* New Britain---- 70, 120, 121
Noonan *v.* Albany---- 84, 132
North Attleborough, Diamond *v*---- 119, 124
North Bloomfield Gravel Mining Co. *v.* Woodruff---- 59
Norwood, Mininger *v*---- 68
Nunemacher, Greene *v*---- 57
Obe *v.* Pattat---- 83
O'Brien, in re---- 101
O'Brien *v.* St. Paul---- 71
Olmstead *v.* Loomis---- 66
Oswald *v.* Wolf---- 65
Otley, Kewanee *v*---- 9
Owen, Embrey *v*---- 62
Packwood *v.* Mendota Coal & Coke Co---- 17
Palmer, Chipman *v*---- 48, 53, 55, 59
Paltrovich, Butte *v*---- 101
Parker *v.* American Woolen Mills Co---- 18, 31, 48, 51, 58, 62, 63
Parker *v.* Griswold---- 62
Parker *v.* Ry---- 16
Parker *v.* Winnipiseogee Lake Co---- 66
Parkhurst, Warren *v*---- 60
Parsons, Snow *v*---- 18, 27, 43, 44, 46, 61, 70
Paterson, Grey *v*---- 77, 119
Pattat, Obe *v*---- 83
Patterson *v.* Colebrook---- 46
Peck *v.* Herrington---- 80
Pendleton, Miller *v*---- 45
Penn American Plate Glass Co. *v.* Schwinn---- 25, 27, 52, 128
Pennington *v.* Brinsop Hall Coal Co---- 48
Pennoyer *v.* Allen---- 43

Page.
Penna. Coal Co. *v.* Sanderson 31, 35, 42, 76
Penna. R. R. Co., Clark *v* 62
People *v.* Cunningham 71
People *v.* Elk River Mill & Lumber Co 73
People *v.* Gold Run, etc., Mining Co 71
People *v.* Hulbert 12, 14, 85, 95, 96
People *v.* Kirk 111
People *v.* La Pell 113
Petaluma, Geurkink *v* 53
Peterson *v.* Santa Rosa 76
Pine, New York *v* 39, 41
Pittenger, Robeson *v* 66
Plamer, Chipman *v* 48
Platt *v.* Waterbury 72, 120, 121, 129
Pope, Varney *v* 66
Pope, Western Paper Co. *v* 24, 42, 49, 52, 59, 128
Porter *v.* Whitman 66
Port Jervis, Bohan *v* 121
Portland *v.* Cook 101
Portland Mfg. Co., Webb *v* 62
Potter, Stockport Water Works Co. *v* 52
Postel, Bonte *v* 54
Powell, Cutter *v* 45
Prentice *v.* Geiger 43, 69
Pumpelly *v.* Green Bay & Miss. Canal Co 117
Ry., Jenkins *v* 16
Ry., Parker *v* 16
Ray *v.* Sellers 70
Rector, Health Department *v* 101
Red Bank Oil Co., Witland *v* 53
Red River Roller Mills Co. *v.* Wright 20, 43, 59, 61
Reid *v.* Gifford 60
Renner *v.* Bank of Columbia 45
Resbridger, Fich *v* 57
Retsof Mining Co., Mann *v* 34
Revere, Brodbine *v* 115
Rhodes *v.* Cleveland 126
Richards, Little Schuylkill Nav. R. & C. Co. *v* 54, 55
Richardson, Littleton *v* 45
Richmond, Attorney General *v* 71
Richmond *v.* Test 49, 69, 127, 128, 130
Richmond Mfg. Co. *v.* Atlantic De Laine Co 23, 25, 58
Rideout *v.* Knox 100
Ripka *v.* Sergeant 62
Roach, L. S. & M. S. R. R. Co. *v* 110
Robb *v.* Carnegie 34, 42
Robb *v.* La Grange 80
Robeson *v.* Pittenger 66
Robinson, Henderson *v* 71
Rochester, Chapman *v* 52, 73, 75, 79, 132
Rochester, Hooker *v* 132
Rochester, N. Y. Central & H. R. R. R. Co. *v* 133
Rochester, Smith *v* 86

Page.
Rocky Mount, Hines *v.* 121
Roselle, Crane *v.* 80
Rothery, New York Rubber Co. *v.* 61
Ruffner, Bowling Coal Co. *v.* 11, 32, 52
R. W. & O. T. R. R. Co., Booth *v.* 132
Rylands, Fletcher *v.* 32
St. Paul, O'Brien *v.* 71
Salem Iron Co. *v.* Hyland 29, 41, 123
Salt Lake City *v.* Young 44, 95
Sanderson, Penna. Coal Co. *v.* 31, 35, 42, 76
Sandusky Portland Cement Co. *v.* Dixon Pure Ice Co 58
Sanitary District, Beidler *v.* 9
Santa Rosa, Peterson *v.* 76
Saratoga Springs, Moody *v.* 131
Saratoga Springs, Stoddard *v.* 132
Schaefer, Woodyear *v.* 46, 48, 59
Schiff, Sowers *v.* 15
Schreiner, Boyd *v.* 61
Schureman, Crocker *v.* 45
Schwertley, Martin *v.* 83
Schwinn, Penn American Plate Glass Co. *v.* 25, 27, 52, 128
Scofield *v.* Lansing 60
Seaman, Campbell *v.* 67
Sedalia, Smith *v.* 123
Seifert *v.* Brooklyn 132
Seisdon Rural District Council, Staffordshire County Council *v.* 113
Sellers, Ray *v.* 70
Sellick *v.* Hall 55
Senior *v.* Anderson 53
Sergeant, Ripka *v.* 62
Serley *v.* Alden 53
Sewall's Falls Bridge Co. *v.* Fisk 45
Sewer District No. 3, Jones *v.* 127
Shaw, Bealey *v.* 70
Shepherd, Booth *v.* 103
Sherley, Barnard *v.* 41, 127, 129, 130
Sherman *v.* Fall River Iron Works Co 48
Shields *v.* Arndt 57
Siegel, Hall *v.* 110
Silver Spring Bleaching & Dyeing Co. *v.* Wansuck Co 23, 48, 58
Simmons *v.* Everson 55
Sisson, Comm. *v.* 95, 99, 100, 115
Slack, West Muncie Strawboard Co. *v.* 49, 55, 56
Slater *v.* Mersereau 56
Sloggy *v.* Dilworth 55
Smith, Hill *v.* 48
Smith, Kraver *v.* 69, 71
Smith, Miss. Mills Co. *v.* 36, 42
Smith *v.* Rochester 86
Smith *v.* Sedalia 123
Snow *v.* Parsons 18, 27, 43, 44, 46, 61, 70
Soltan *v.* De Held 66
Somers, Blackburne *v.* 71

Page.
Southern Coal & Transportation Co., State *v*---- 34, 107
Sowers *v.* Schiff---- 15
Sparkman *v.* Swift---- 54
Spellmire, State *v*---- 103
Sprague *v.* Dorr---- 90, 99, 100
Sprigg *v.* Garrett Park---- 94
Springs, Manigault *v*---- 118, 119
Staffordshire Potteries Co., Clowes *v*---- 66
Staffordshire County Council *v.* Seisdon Rural District Council---- 113
Standard Bag, etc., Co., Cleveland *v*---- 50
Standard Mining Co., Hill *v*---- 25
State *v.* Bargus---- 103
State *v.* Broadbelt---- 94
State, Dennis *v*---- 49
State, Gentsch *v*---- 103
State *v.* Griffin---- 89, 104
State *v.* Gurry---- 116
State *v.* Hyman---- 94
State, McGill *v*---- 103
State *v.* Morse---- 95
State *v.* Southern Coal & Transportation Co---- 34, 107
State *v.* Spellmire---- 103
State *v.* Wheeler---- 91, 105, 107
State Board of Health *v.* Diamond Mills Paper Co---- 95, 104, 107
State Board of Health *v.* Greenville---- 93, 101, 116
State Board of Health, Nelson *v*---- 95, 115, 116
Stein *v.* Barden---- 68
Stein, Lewis *v*---- 72, 91, 95
Steinkamp, Cincinnati *v*---- 103
Stephens, Blaisdell *v*---- 55, 59
Sterling Iron & Zinc Co., Beach *v*---- 14, 32, 34, 47, 58, 67, 120
Stevens, Johns *v*---- 62
Stevenson *v.* Coal Co---- 25
Stewart, Clark *v*---- 66
Stockport Water Works Co. *v.* Potter---- 32
Stoddard *v.* Saratoga Springs---- 132
Stover *v.* Whitman---- 45
Straight *v.* Hover---- 39, 52
Straight Creek Coal & Coke Co., Comm. *v*---- 109
Strobel *v.* Kerr Salt Co---- 11, 34, 44, 48, 49, 58, 60
Sullivan, C., H. & D. R. Co. *v*---- 94
Sutcliffe, Wood *v*---- 10
Swift, Sparkman *v*---- 54
Swindell, Long *v*---- 55
Taft, MacNamara *v*---- 19, 51, 59, 61
Talbott *v.* Butte City Water Co---- 101
Taylor, Columbus Co. *v*---- 32
Taylor, McEvoy *v*---- 13, 17
Tearney, Laflin & Rand Powder Co. *v*---- 43
Tenn. Coal, Iron & R. Co. *v.* Hamilton---- 18, 35, 49, 52
Test, Richmond *v*---- 49, 69, 127, 128, 130
Tetherington *v.* Donk Bros. Coal & Coke Co---- 9, 52
Tewksbury, Comm. *v*---- 92, 106

Pages.
Texarkana, Carmichael *v*. 126
Thomas *v*. Brockney 52, 62
Thomas *v*. Grinnell 83
Thorpe *v*. Brumfitt 59
Threatt *v*. Mining Co 36, 119
Thurber *v*. Martin 44
Tiffin *v*. McCormack 43
Tillotson, Wadsworth *v*. 120
Train *v*. Boston Disinfecting Co 115
Trimble, Belknap *v*. 66
Troy, C. H. & D. Ry. Co. *v*. 94
Troy Iron & Nail Factory, Corning *v*. 62
Tucker, Columbus & Hocking Coal & Iron Co. *v*. 34, 45, 51
Tunbridge Wells Improvement Commissioners, Goldsmid *v*. 68, 70, 74, 124
Turner, Ala. Consolidated Coal & Iron Co. *v*. 68
Ulbricht *v*. Eufaula Water Co 63, 68, 86
Union Cattle Co., Barton *v*. 14, 28, 31, 42, 59
United States *v*. Lynah 117, 119
United States, Mills *v*. 118
Upton, Comm. *v*. 71, 111
Valparaiso *v*. Hagen 123, 127, 128, 129, 130
Valparaiso *v*. Moffitt 55
Van De Vere *v*. Kansas City 122
Varney *v*. Pope 66
Veazie *v*. Dwinel 71
Von Mills *v*. Nashua 75
Wadsworth *v*. Tillotson 120
Waffle *v*. N. Y. Central Ry. Co. 14
Waldron, Hayes *v*. 21, 46, 61
Walker *v*. Aurora 111
Walker, Gladfelter *v*. 47, 62
Waltham, Collins *v*. 80
Wansuck Co., Silver Spring Bleaching & Dyeing Co. *v*. 23, 48, 58
Warren *v*. Parkhurst 60
Warren Mfg. Co., Baltimore *v*. 10, 48
Waterbury, Platt *v*. 72, 120, 121, 129
Watertown, Daley *v*. 81
Waud, Wood *v*. 62
Waukesha, Winchell *v*. 52, 73, 79, 121, 125, 126, 129
Waupaca Starch & Potato Co., Middlestadt *v*. 24, 58
Webb, Moore *v*. 70
Webb *v*. Portland Mfg. Co. 62
Webber *v*. Gage 66
Welch *v*. Coglan 94, 116
Wendt, Bowen *v*. 71
West *v*. L. & N. R. R. 70
Western, Bush *v*. 57
West Muncie Strawboard Co. *v*. Slack 49, 55, 56
Weston Paper Co. *v*. Pope 24, 42, 49, 52, 59, 128
Wheeler, State *v*. 91, 105, 107
Wheeler *v*. Worcester 80, 81
White Spring Paper Co., Worthen *v*. 11, 21, 59

Page.
Whitman, Porter *v*---- 66
Whitman, Stover *v*---- 45
Wiest *v.* Electric Traction Co---- 54
Williams *v.* Haile Gold Mining Co---- 36, 119
Wilmington & Weldon Ry. Co., Wolcutt *v*---- 16
Wilson, N. N. & M. V. Co. *v*---- 17
Winchell *v.* Waukesha---- 52, 73, 79, 121, 125, 126, 129
Winfield *v.* Worcester---- 80
Winnipiseogee Lake Co., Parker *v*---- 66
Winnipiseogee Mfg. Co., Coe *v*---- 66
Witland *v.* Red Bank Oil Co.---- 53
Wolcutt *v.* Wilmington & Weldon Ry. Co---- 16
Wolf, Oswald *v*---- 65
Wood, Irvine *v*---- 55
Wood *v.* Sutcliffe---- 10
Wood *v.* Waud---- 62
Woodbury *v.* Bromly---- 80
Woodruff *v.* North Bloomfield Gravel Mining Co---- 59
Woodward *v.* Worcester---- 67
Woodyear *v.* Schaefer---- 46, 48, 59
Worcester Flagg *v*---- 80
Worcester, Merrifield *v*---- 127
Worcester, Morse *v*---- 130
Worcester, Wheeler *v.*---- 80, 81
Worcester, Winfield *v*---- 80
Worcester, Woodward *v*---- 67
Worthen *v.* White Spring Paper Co---- 11, 21, 59
Wright *v.* Moore---- 68
Wright, Red River Roller Mills Co. *v*---- 20, 43, 59, 61
Yohn, Bard *v*---- 54
Young *v.* Bankier Distillery Co---- 33, 34
Young, Salt Lake City *v*---- 44, 95
Zehner, Hammon *v*---- 62

APPENDIXES.

APPENDIX I.

TREATY BETWEEN THE UNITED STATES AND GREAT BRITAIN RELATING TO BOUNDARY WATERS BETWEEN THE UNITED STATES AND CANADA.

(January 11, 1909.)

PRELIMINARY ARTICLE.

For the purposes of this treaty boundary waters are defined as the waters from main shore to main shore of the lakes and rivers and connecting waterways, or the portions thereof, along which the international boundary between the United States and the Dominion of Canada passes, including all bays, arms, and inlets thereof, but not including tributary waters which in their natural channels would flow into such lakes, rivers, and waterways, or waters flowing from such lakes, rivers, and waterways, or the waters of rivers flowing across the boundary.

ARTICLE IV.

* * * It is further agreed that the waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other.

ARTICLE VII.

The high contracting parties agree to establish and maintain an International Joint Commission of the United States and Canada, composed of six commissioners, three on the part of the United States appointed by the President thereof and three on the part of the United Kingdom appointed by His Majesty on the recommendation of the governor in council of the Dominion of Canada.

ARTICLE X.

Any questions or matters of difference arising between the high contracting parties involving the rights, obligations, or interests of the United States or of the Dominion of Canada, either in relation to each other or to their respective inhabitants, may be referred for decision to the International Joint Commission by the consent of the two parties, it being understood that on the part of the United States any such action will be by and with the advice and consent of the Senate, and on the part of His Majesty's Government with the consent of the governor general in council. * * *

APPENDIX II.

STATE LEGISLATION RELATING TO THE POLLUTION OF STREAMS.

In connection with the foregoing digest of judicial decisions, the following compilation was made of the legislation in force in the different States for preventing the pollution of streams, including the more recent regulations of State health authorities. In addition to its relation with the preceding pages, this appendix was prepared to show the present status of such legislation. For this reason it has been made as comprehensive as possible and includes a large number of laws whose effect on the pollution of human water supplies seems almost accidental, a good example of which is the mass of legislation prohibiting putting into water any substance harmful to fish. In spite of the effort to make the compilation complete, however, all laws which might be interpreted as being related to the subject could not be given. For instance, although stream pollution is definitely regarded as a nuisance in some States and might be so considered by the courts in other States, yet the nuisance laws of the country are too voluminous to be given in full in this appendix. Therefore, the definition of nuisances, except those which specifically mention pollution of streams, and the detailed process of abatement of nuisances, have been omitted. Laws authorizing the closing of cemeteries which are a menace to health were omitted, although the menace might result from the proximity of a stream. Laws authorizing municipalities to compel connections with sewers were omitted, although preventing pollution of streams is an important reason for sewerage.

In excluding certain kinds of legislation, it was therefore necessary to draw an arbitrary line, which may be roughly explained by a few illustrations. Provisions as to the use of explosives in taking fish were omitted, provisions as to the use of poisons for the same purpose were included; general authority for a State laboratory to make examinations of water was omitted, special authority for the same purpose in case the water was suspected of being contaminated was included; sections providing penalties for injury to waterworks were omitted, sections providing penalties for injury to the water itself were included; laws against offensive trades in cities were omitted except where it appeared that the legislators had considered the nuisance occasioned by the disposal of the wastes of such trades in the streams of the cities. To avoid some of the difficulties of so rigid

a classification, there have been included in the compilation a number of interesting laws which were strictly without the boundary set.

In preference to following strictly the punctuation and capitalization of the laws it has been found advisable to adopt a uniform system.[1] Furthermore, unimportant typographical errors in the text of the laws have been corrected. Where mistakes of more moment occurred the original form has been kept, followed by the word "sic" in brackets, or the correct form has been supplied and the original form recorded in a footnote. The greatest care has been taken to make the text, apart from these minor changes, an accurate copy of the codes or session laws. Phrases in brackets were supplied by the compiler of this appendix; those in parentheses are a part of the law or were supplied by the compiler of the code from which the law was taken. As a rule italic side headings are not a part of the laws. They were supplied by the compiler for ease of reference and to secure uniformity, and as a rule relate specifically to the pollution of streams rather than to the main idea of a given section.

The compilation includes all laws relating to the subject available[2] on October 10, 1917. This means that in general the session laws of 1917 have been consulted, but in the following States such laws were not available: Alabama, Arkansas, District of Columbia, Florida, Georgia, Indiana, Iowa, Kansas, Kentucky, Mississippi, Nebraska, Oklahoma, Philippines, Rhode Island, Vermont, Virginia, and Wisconsin. Several of these States had no legislative sessions in 1916, so that the latest laws quoted from them would have been passed in 1915. In the case of some States whose 1917 laws could be consulted only a part were available; for instance, the New York laws were consulted through chapter 809 and the Pennsylvania laws through chapter 426.

ALABAMA.

[CODE OF 1907.]

702 (as amended by act No. 619, 1915). *State board of health to examine sources of water supply and prevent pollution of water.*—The State board of health shall, through its executive officer, have authority and jurisdiction:

(5) To examine the sources of supply, reservoirs, and avenues of conveyance of drinking water furnished to incorporated cities and towns, and whenever these waters are found polluted, or conditions are discovered likely to bring about their pollution, proper steps shall be taken to improve or correct conditions.

708 (as amended by act No. 619, 1915). *County boards of health to supervise water supplies and prevent pollution of same.*—It shall be the duty of county boards of health:

[1] That of the Government Printing Office.
[2] At the Congressional Library, Washington, D. C.

(4) To exercise through their committees of public health and health officers special supervision * * * over the sources of supply, reservoirs, and avenues of conveyance of drinking water furnished to incorporated towns in their respective counties; and whenever unsanitary conditions are found in any of these places or institutions it shall be the duty of the executive officer or other official of the State board of health to order the county or municipal health officer under whose jurisdiction the unsanitary condition is found to use all authority in his power to have the same abated.

3488 (as amended by act No. 59 of 1909). *Waterworks companies may acquire riparian rights, etc., to prevent pollution of water.*—Corporations authorized to construct and operate waterworks for the supplying of cities, villages, towns, and their inhabitants, or others living or doing business in the vicinity of them, with water * * * may * * * acquire by condemnation riparian rights and all such lands adjacent to such streams or water sources [as are used for water supply] as shall be necessary to protect and preserve the purity of such supply * * *. The power of condemnation herein given shall include the right to condemn, wherever necessary, for any of the purposes hereinbefore mentioned, any yard or curtilage of a dwelling house, garden, stable, lot, or barn, or so much thereof as may be necessary; and whenever the ownership of the mineral interest in lands has been severed from the ownership of the surface, and the mining of the minerals would endanger any proposed canal, storage pond, or reservoir, said water companies may institute ad quod damnum proceedings against the owner or owners of the minerals situate under the proposed canal, reservoir, or storage ponds in the probate court of the county in which the lands are situated in accordance with the general laws of the State, condemning said mineral interests or so much thereof as may be required for the support of the surface where said canal, reservoir, or storage pond is to be located. * * *

6899. *Poisoning streams to catch fish.*—Any person who takes, catches, kills, or attempts to take, catch, or kill fish in any waters of the State, by poisoning the stream or body of water in which they are found, or by the use of any poisonous substance put in the water, or by the use of fishberries, lime * * * must, on conviction, be fined not less than ten nor more than one hundred dollars, to be paid into the State treasury to the credit of the game and fish protection fund.

7426. *What nuisances are indictable.*—Any person who shall erect, or continue, after notice to abate, a nuisance which tends or threatens to injure the health of the citizens in general, or to corrupt the public morals, shall be guilty of a misdemeanor. (Sec. 718, as amended by act No. 789, 1915, gives the process of abatement. It has been omitted from this compilation.)

7575. *Poisoning springs, wells, etc.*—Any person who willfully or wantonly poisons any spring, fountain, well, or reservoir of water must, on conviction, be imprisoned in the penitentiary for not less than 10 nor more than 20 years.

7622. *Misdemeanor for which no special punishment has been provided.*—Any person who commits a public offense which is a misdemeanor at common law or by statute, and the punishment of which is not particularly specified in this code, must on conviction be fined not more than $500, and may also be imprisoned in the county jail or sentenced to hard labor for the county for not more than six months.

7874. *Depositing dead animals and fowls in running streams.*—Any person who deposits the body of a dead animal or fowl in any running stream must, on conviction, be fined $10, and one-half of the fine must go to the informer. Justices and constables are especially charged with the enforcement of this section.

7875. *Polluting water supply of town or city.*—It shall be unlawful for any person to knowingly deposit any dead animal or nauseous substance in any source, standpipe, or reservoir from which water is supplied to any city or town of this State. Any person violating the provisions of this section shall be guilty of a misdemeanor and, upon conviction, shall be punished by a fine not exceeding $500, and may be sentenced to hard labor for the county not exceeding one year.

[ACT No. 675 OF 1915.]

SECTION 1. *To give State board of health supervision and control over sources of water supply.*—The State board of health shall exercise supervision over, and shall from time to time, by its employees or agents, examine the source of supply of the various waterworks systems in this State, and also the method of filtering and treating such water and delivering the same to consumers. The State board of health shall from time to time make such recommendations to any person, company, corporation, or municipality supplying water for domestic purposes to consumers as will tend to improve the water supply or to preserve its purity.

SEC. 2. *Board of health to examine water supplies.*—It shall be the duty of the State board of health to procure, as often as once every three months, and oftener if in the opinion of the president of the State board of health it should be necessary, a sample of water furnished to consumers by each person, company, corporation, institution, or municipality in this State which supplies water for domestic purposes to the public from or by means of any waterworks or waterworks system. It shall be the duty of the State board of health to cause a bacteriological examination to be made of the samples of water so procured, and to record such analyses in a book kept for that purpose in the office of the State board of health, and to furnish to the municipal authorities in which the waterworks system is located a copy of such analyses, and, if such waterworks system is owned by an individual or private corporation, to furnish a copy of such analyses to such individual or private corporation also.

SEC. 3. *Board of health to direct steps to purify polluted water.*—The State board of health is charged with the duty of inspecting from time to time the quality of water furnished to consumers by any person, firm, corporation, association, or municipality; and when it has been ascertained by the State board of health that any water furnished to consumers is impure, or is unfit for human consumption, or is likely to cause disease in man, the State board of health shall notify the person, company, corporation, institution, or municipality furnishing to consumers the water which is found to be impure, and shall direct (that) such steps shall be taken to purify such water supply, and to prescribe the time within which such steps shall be taken to make such water supply conform to the requirements of the State board of health; and if any such person, firm, corporation, institution, or municipality shall fail within the time required by such order to take the steps required by the State board of health, and remove the cause of complaint, the State board of health shall publish in a newspaper published in the county a statement to consumers of water so found to be impure, calling their attention to the impurity of the water supply and directing them as to the course to be taken for the preservation of the health of such consumers.

SEC. 4. *Board of health to approve waterworks.*—After the passage of this act no waterworks plant or system shall be constructed until application has been made to the State board of health for a permit stating the place where such waterworks system is to be constructed and describing the source of the water supply, and no new source of water supply shall be established or

developed until a like application for a permit is filed with the State board of health describing such new or additional water supply which it is proposed to develop. When such application is made it shall be the duty of the State board of health within 30 days thereafter to examine the source of supply and the drainage of the land adjacent thereto and to analyze the water and determine whether it is or not or can be made pure and wholesome and suitable as a domestic water supply. The State board of health shall pay particular attention to the watershed which it is proposed to utilize and the liability of the same to pollution, and it shall not approve the application of any person, firm, corporation, or municipality to develop or utilize a source of supply where the water is unfit for use or likely to become so. The State board of health, in making such examination, shall consider all the facts and circumstances bearing upon the source of supply and the possibility of its contamination, and if it ascertains that the water is unfit for domestic purposes, is contaminated or likely to become so, or that the drainage of the watershed is likely to cause pollution of said water supply in such a way that the same can not be remedied, the State board of health shall refuse to grant to any person, company, corporation, institution, or municipality a permit to utilize said water supply, provided, however, that the State board of health may issue said permits if the water so proposed to be used can be purified, and the person, firm, corporation, or municipality desiring to develop or utilize the same will comply with the requirements of the State board of health and treat and purify such water in the manner prescribed by it.

SEC. 5. *Permit from board of health required.*—No person, firm, corporation, institution, or municipality shall hereafter construct any waterworks or waterworks system for supplying water for domestic purposes to the public without having first obtained a permit from the State board of health as provided in the preceding section, and no municipal corporation shall be authorized to incur any debt or to issue any bonds in aid of such water supply unless a permit shall first have been obtained from the State board of health approving the source of supply as set out in the preceding section.

SEC. 7. *Not to take away power of municipalities to regulate source of water supply.*—No provision of or contained in any section of this act shall be construed to be in conflict with or to supplant any power now or hereafter to be vested in municipal corporations to regulate, supervise, or control the source or sources of supply of waterworks plants or systems supplying water to cities and towns and the inhabitants thereof, to provide for examinations or analysis of water, to prescribe the conditions upon which waterworks plants may be built or the sources of supply changed or enlarged, or to prevent the furnishing of impure or polluted water or provide for the purity of water supplies or the maintenance of the purity thereof.

[ACT No. 691 OF 1915.]

SECTION. 1. *Limitation on manufacturing plant becoming a nuisance.*—No manufacturing or other industrial plant or establishment, or any of its appurtenances, or the operation thereof, shall be or become a nuisance, private or public, by any changed conditions in and about the locality thereof after the same has been in operation for more than one year, when such plant or establishment or its appurtenances, or the operation thereof, was not a nuisance at the time the operation thereof began[1]: *Provided*, That the provisions hereof shall not apply whenever a nuisance results from the negligent or improper operation of any such plant, establishment or any of its appurtenances: *And*

[1] Law reads "begun."

provided further, That the provisions of this act shall not affect or defeat the right of any person, firm or corporation to recover damages for any injuries or damages sustained by them on account of any pollution of, or change in the condition of, the waters of any stream, or on account of any overflow of the lands of any person, firm or corporation.

SEC. 2. *Certain ordinances null and void.*—Any and all ordinances now adopted, or hereafter adopted,[1] by any municipal corporation in which such plant is located, operating to make the operation of any such plant or establishment, or its appurtenances, a nuisance, or providing for an abatement thereof as a nuisance, in the circumstances set forth in the preceding section are and shall be null and void: *Provided*, That the provisions hereof shall not apply whenever a nuisance results from the negligent or improper operation of any such plant, establishment, or any of its appurtenances: *Provided further*, That section two of this act shall not be construed to invalidate any contracts heretofore made, but in so far as contracts are concerned this act only applies to contracts and agreements to be made in the future.

[SANITATION OF CAMPS AND RESORTS, REG. BD. OF H., MAY 16, 1913.]

202. The owner, agent, manager, or foreman of any lumbering camp, mining camp, sawmill camp, railroad camp, boarding car or construction camp, pleasure camp or resort, or so-called open-air health resort, or industry requiring the establishment of a camp, shall be responsible for the proper execution and enforcement of any regulations herein contained, or of any clause of any health regulation governing any case or circumstance for the proper sanitation and cleanliness thereof.

204. Garbage and all refuse shall be disposed of so as not to create a nuisance or to contaminate drinking water, and in all and other respects conform to the regulations as provided elsewhere.

ALASKA.

[COMPILED LAWS, 1913.]

1908. *Poisoning wells, etc.*—Whoever * * * willfully poisons any well, spring, cistern, or reservoir of water shall be imprisoned in the penitentiary not more than 15 years nor less than 2 years.

2039. *Polluting water used for domestic purposes.*—Any person who shall put any sewage, drainage, or refuse, or polluting matter, as either by itself or in connection with other matter will corrupt or impair the quality of any well, spring, brook, creek, branch, or pond of water which is used or may be used for domestic purposes, shall be deemed guilty of a misdemeanor.

[2040 (as amended by Session Laws of 1913, chap. 81).] *Putting dead*[2] *animal into water supply.*—Any person, firm, or corporation who puts any dead animal carcass, or part thereof, excrement, putrid, nauseous, noisome, decaying, deleterious, or offensive substance into, or in any other manner not herein named befouls, pollutes, or impairs the quality of any spring, brook, creek, branch, well, or pond of water which is or may be used for domestic purposes, * * * shall be considered as creating or maintaining a nuisance, and any person, firm, or corporation who shall neglect or refuse to abate such nuisance upon order of any health officer shall be guilty of a

[1] Law reads "adopted are or hereafter adopted."

[2] Chapter 81, Session Laws of 1913, amended Sec. 160, Chapter 10, act of March 3, 1899, this section appearing as 2040 in the Compiled Laws, 1913.

misdemeanor and punished as provided in section 161 [sec. 2041] of this chapter, and in addition to such punishment the court or justice shall assess judgment against the defendant for the expenses of abating such nuisance, which judgment shall be enforced in the same manner as an execution in a civil action.

2041. *Penalty.*—Any person violating the provisions of either of the two sections last preceding shall, upon conviction, be fined not less than ten nor more than fifty dollars, or be imprisoned not less than five nor more than twenty-five days, or by both fine and imprisonment.

2072. *Punishment for misdemeanor.*—Whenever, by any law relating to said district,[1] an act is declared to be a misdemeanor, and no punishment is prescribed therefor, the person committing the same, upon conviction thereof, shall be punished by imprisonment in the county jail not more than one year, or by fine not more than five hundred dollars.

[SESSION LAWS OF 1913, CHAP. 50.]

SECTION 1. *Unlawful to cast lumber waste into salmon streams, etc.* It shall be unlawful for the proprietor of any sawmill in this Territory or any employee therein, or any other person, to cast sawdust, planer shavings, or other lumber waste made by any lumbering or manufacturing concern, or to suffer or to permit such sawdust, shavings, or other lumber waste to be thrown or discharged in any manner into any of the streams entering into salt waters of this Territory or bays immediately adjacent to salmon streams, or to deposit the same where high water will take the same into any of the waters of this Territory.

SEC. 2. Any person violating this act shall be guilty of a misdemeanor.

ARIZONA.

[REVISED STATUTES, 1913, CIVIL CODE.]

4370. *Rules and regulations of State board of health.*—The board [State board of health] shall have power, and it shall be its duty:

(3) To make and enforce all needful rules and regulations for the prevention and cure and to prevent the spread of any contagious, infectious, or malarial diseases among persons and domestic animals.

4403. *Penalty for violation of rules and regulations.*—* * * Any person who fails to comply with or violates any of the provisions of this chapter [Chap. I, board of health, of title 41, public health] * * * shall be guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than ten nor more than fifty dollars, or by imprisonment in the county jail not exceeding thirty days, or by both; and any physician convicted under this chapter shall have his license revoked.

[REVISED STATUTES, 1913, PENAL CODE.]

19. *Penalty for misdemeanor.*—Except in cases where a different punishment is prescribed by this code, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding six months or by a fine not exceeding three hundred dollars, or by both.

348. *Poisoning of water supplies.*—Every person * * * who willfully poisons any spring, well, or reservoir of water is punishable by imprisonment in the State prison for a term not less than one nor more than ten years.

[1] Refers to Territory of Alaska.

383. *Definition of public nuisance.*—Anything which is injurious to health or is indecent or offensive to the senses or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property by an entire community or neighborhood, or by any considerable number of persons, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, river, bay, stream, canal, or basin, * * * is a public nuisance.

384. *Where damage is unequal.*—An act which affects an entire community or neighborhood, or any considerable number of persons, as specified in the last section, is not less a nuisance because the extent of the annoyance or damage inflicted upon individuals is unequal.

385. *Committing of public nuisance a misdemeanor.*—Every person who maintains or commits any public nuisance, the punishment for which is not otherwise prescribed, or who willfully omits to perform any legal duty relating to the removal of a public nuisance, is guilty of a misdemeanor.

386. *Putting bodies of dead animals, etc., into streams.*—Every person who puts the carcass of any dead animal or the offal from any slaughter pen, corral, or butcher shop into any river, creek, pond, reservoir, stream; * * * and any person who puts any water-closet or privy or the carcass of any dead animal or any offal of any kind in or upon the borders of any stream, pond, lake, or reservoir from which water is drawn for the supply of the inhabitants of any city or town in this State, so that the drainage from such water-closet, privy, carcass, or offal may be taken up by or in such stream, pond, lake, or reservoir; or who allows any water-closet or privy or carcass of any dead animal or any offal of any kind to remain in or upon the borders of any such stream, pond, lake, or reservoir within the boundaries of any land owned or occupied by him, so that the drainage from such water-closet, privy, carcass, or offal may be taken up by or in such stream, pond, lake, or reservoir; or who keeps any horses, mules, cattle, swine, sheep, or live stock of any kind penned, corralled, or housed on, over, or on the borders of any such stream, pond, lake, or reservoir, so that the waters thereof become polluted by reason thereof, or who bathes in any such stream, pond, lake, or reservoir; or who by any other means fouls or pollutes the water of any such stream, pond, lake, or reservoir, is guilty of a misdemeanor.

536. *Depositing filth in reservoirs, etc.*—Every person * * * who shall empty or place, or cause to be emptied or placed, into any such canal, ditch, or flume or reservoir [used for the purpose of holding or conveying water for manufacturing, agricultural, mining, irrigation, or generation of power or domestic uses] any rubbish, filth or obstruction to the free flow of the water is guilty of a misdemeanor.

660. *Use of poison for taking fish.*—Every * * * poisonous or stupefying substance or device used or intended for use in taking or killing * * * fish in violation of this title [Title 18, Preservation of game and fish] and * * * kept, or found in or upon any of the streams or waters of this State or upon the shores thereof * * * is hereby declared a nuisance and may be abated and summarily destroyed by any person, and it shall be the duty of every officer authorized to enforce this title to seize and summarily destroy the same and no prosecution or suit shall be maintained for such destruction * * *.

683. *Fish must be taken by means of hook and line only.*—It shall be unlawful for any person or persons to catch, kill, or have in his or their possession any species of trout or game-food fish found in any of the public streams or waters of this State unless said fish has been taken with a hook and line attached to a rod or held in the hand, and any person or persons catching, killing, or having in their possession, any such fish, taken in any other manner shall be deemed

guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than $25 nor more than $50 or by imprisonment for not less than 10 days nor more than 80 days, or by both such fine and imprisonment, in the discretion of the court, and every fish caught or killed in violation hereof, shall constitute a separate and distinct offense.

ARKANSAS.

[DIGEST OF THE STATUTES, 1916.]

617. *Regulations of State Board of Health.*—Power is hereby conferred on the Arkansas State Board of Health to make all necessary and reasonable rules and regulations of a general nature for the protection of the public health, and for the general amelioration of the sanitary and hygienic conditions within the State, for the suppression and prevention of infectious, contagious and communicable diseases * * *.

644. *Punishment for violation of regulations of board.*—Every firm, person, or corporation, violating any of the provisions of this act [section 617, but not section 620 is a part of the act] of [or] any of the orders, rules, or regulations made and promulgated in pursuance hereof, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than $10 nor more than $100, or by imprisonment not exceeding one month or both.

2051. *Poisoning streams for any purpose.*—Any person who shall poison any lake or stream of water for the purpose of killing stock, or for any other purpose, shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in any sum not less than $100 nor more than $500.

3330. *Misdemeanor to pollute water.*—If any person * * * shall pollute the water [in or near the impounding dams or reserovirs of any water plant] or affect its wholesome qualities, he shall be deemed guilty of a misdemeanor and be fined for each and every offense in any sum not exceeding $200.

4045. *Poisoning streams for purpose of killing fish.*—It shall be unlawful for any person, with the intent to kill, maim, or paralyze any fish or other water animal, to cast, drop, or otherwise deposit in any river, creek, lake, or pond, or in any other stream or body of water within this State any intoxicating or stupefying liquid, drug, vegetable, or fruit, or to take from any river, creek, lake, pond, or other stream or body of water within this State, any fish so stupefied, intoxicated, or killed.

4047. *Penalty.*—Any person found guilty of violating either of the provisions of sections 4045 * * *, upon indictment in the circuit court or before a justice of the peace of the proper county, shall be fined for each offense not less than $5 nor more than $25.

6468. *Municipal corporations have power to prevent pollution of water.*—They [municipal corporations] shall have power * * * to prevent pollution of water * * * and its [their] jurisdiction to prevent or punish any pollution or injury to the stream or source of water, or to the waterworks, shall extend 5 miles beyond the corporate limits.

[PRIVIES AND CESSPOOLS. REG. BD. OF H., MAY 16, 1913.]

214. In cities, towns, and villages, incorporated or unincorporated, all human excreta shall be deposited in sewers, cesspools, vaults, septic tanks, dry closets, or incinerators of special construction.

215. All cities and towns not now operating a sewerage system shall, before undertaking the installation of such system, present the proposed plan, together with the plan for the proposed final disposal of sewage, for the approval of the State board of health.

216. Cesspools and vaults shall be of water-tight construction for holding excreta and be made fly proof, and whenever the contents reach within 2 feet of the ground surface must be cleaned out to the bottom. They shall at least once a year, and at such other times as may be considered necessary by the health officer, be thoroughly emptied and cleaned.

217. Cesspools and vaults shall be constructed in accordance with plans and specifications approved by the State board of health.

218. No part of the contents of any privy shall be removed therefrom nor shall the same be transported through or over any streets or highways except as the same shall be removed and transported by means of some air-tight apparatus, pneumatic, or other process, so as to prevent the contents from being agitated or exposed to the open air during the process of such removal or transportation.

219. Where persons are employed or intended to be employed in any trade, occupation, or business there shall be provided sufficient and suitable privy accommodations, having regard to the number of persons employed or in attendance; and also where persons of both sexes are employed or intended to be employed or in attendance sufficient and separated privy accommodations shall be provided for each sex.

220. The term "privy" shall be held to mean any building or part of a building used or intended to be used for the reception of human excreta and which is not connected with the public sewer or some duly authorized system of sewage disposal so as to immediately remove such material from such building.

221. No person, firm, or corporation shall own, maintain, or rent any privy in any incorporated or unincorporated city, town, or village unless the same shall be so constructed as to prevent the soil from contamination; and to prevent the access of flies to the excrement deposited therein by means of wire gauze, 18 strands to the inch in each direction; and to permit the easy and proper placing and removal of a receptacle, the dimensions of which shall be at least 16 inches in height and 15 inches in diameter.

222. Regulation 216 applies to all schoolhouses, churches, camps, mills, depots, factories, public buildings, railroad stations, boarding and construction cars.

223. Dry closets shall be constructed in accordance with plans and specifications furnished by the State board of health.

224. All dry closets shall be kept free from odor, and for this purpose dry pulverized earth, ashes, or chloride of lime shall be used to cover at all times the excreta. Dry closets shall have containers emptied at least once in every two weeks, and as often as may be necessary.

225. Human excreta shall not be used for fertilization purposes except the same has been treated by a method by the State health officer.

226. Human excreta taken from cesspools, vaults, or dry closets shall be buried or incinerated. When such excreta is buried it shall be planted to a depth of not less than 3 feet and not less than 300 feet from any water supply, and shall not be buried within the corporate limits of any city or town, nor within 500 yards of any habitation.

227. No abandoned well or deep well shall be used for sewage or a receptacle for household waste.

228. No privy vault, cesspool, or reservoir into which a privy, water-closet, sink, or stable is drained, except it be water-tight, shall be established in water-

bearing strata or within 150 feet of any well, spring, or any other source of water used for drinking or culinary purposes.

229. All privy vaults, reservoirs, or cesspools named in regulation 217 shall be cleaned and emptied of their contents at least once every year before the 1st day of May and shall at all times be kept thoroughly deodorized and disinfected by adding to the contents thereof at least once each month, or oftener if necessary, calcium hypochlorite as follows: Take the calcium hypochlorite in powder form and sprinkle over the contents until the odor is abated, stirring contents if necessary. All privy vaults within the limits of any city or town shall not be less than 5 feet deep and shall be constructed of brick set in cement, or of concrete construction.

230. No privy vault, water-closet, cesspool, sink, or stable drain shall open into any ditch, stream, or drain, except into the public sewers of any city or into disposal tanks equipped with aerated contact or trickling filters of ample area.

231. All sewer drains leading to outfalls or disposal plants shall be of standard construction, and no sewer drain or outlet from any sewage-disposal plant, except as hereinafter provided, shall empty into any lake, pond, creek, stream, or open field.

232. Septic tanks or other disposal tanks shall be made of water-tight concrete or masonry construction. The filters of disposal plants, except in isolated locations in nonwater-bearing strata, shall be installed in basins with water-tight bottoms and side walls.

233. All disposal plants not discharging the effluent into an established sewer system shall be provided with aerated filter beds constructed of proper filtering materials and of sufficient capacity to render the effluent clear and nonputrescible at all seasons of the year: *Provided*, That in the case of country residence and other isolated locations the effluent from septic tanks or cesspools or other types of sewage disposal need not be subjected to filtration if such effluent can be discharged in sufficient isolation to prevent the creation of a nuisance or a menace to health, and in any case the pollution of any source of domestic water supply must be avoided.

234. The nonputrescibility of effluents shall be determined by recognized tests.

235. If the effluent from the filters shall be discharged into any watercourse, open drain, stream, or pond or source of water supply, or upon any lowland where in any manner by drinking the effluent or water polluted by it, or by contact with the same, either by man or beast, pathogenic germs may be transmitted, such effluent shall be sterilized by calcium hypochlorite or other suitable and safe chemical means.

236. The discharge of the effluent from septic disposal plants or any other type of disposal plant into abandoned wells or into crêviced strata reaching water-bearing strata from which a domestic or public water supply is drawn is prohibited.

237. The different methods of irrigation and intermittent filtration are not intended to be excluded by the above requirements, but are also permitted and recommended where the conditions and surroundings will allow such methods of sewage disposal to be safely employed without creating a nuisance or menace to public health and without polluting any source of domestic or public water supply.

[PROTECTION OF WATER SUPPLIES. REG. BD. OF H., MAY 16, 1913.]

238. *Water pollution.*—Any person or persons, firm, company, corporation, or association in this State, or the managing agent of any person or persons, firm,

company, corporation, or association in the State, or any duly elected, appointed, or lawfully created State officer in this State, or any duly elected, appointed, or lawfully created officer of any county or municipality in this State, shall not deposit, permit, or allow any person or persons in their employ or under their control, management, or direction to deposit in any of the waters, lakes, rivers, streams, wells, and ditches in this State any rubbish, filth, or poisonous or deleterious substance or substances liable to affect the health of persons, fish, or live stock, or place or deposit any deleterious substance or substances in any place where the same may be washed or infiltrate into any of the waters herein named.

239. *Potable waters.*—It shall be the duty of local health officers to make an inspection of the sources of water supply of the several communities within their jurisdiction as may be necessary in order to ascertain whether the water from same is pure and wholesome; to take all usual and reasonable measures and precautions to secure and preserve its purity and wholesomeness.

240. Water from wells should be drawn only by the use of pumps and shall be protected from seepage by a water-tight covering.

241. No well may be excavated or dug on any premises used as a bakery or bake shop, and if such now exists the same shall be immediately filled up to the surface of the ground. The boring of an artesian well is not prohibited.

242. When the Arkansas State Board of Health shall, for the better protection of the water supply from pollution and to insure as far as possible the purity and wholesomeness of such water supply and to safeguard the public health in any city, town, or community in this State, make any order or regulation the execution of which will require or make necessary the securing of another water supply, or the modification or extension of any methods of water purification, or the construction and maintenance of a sewerage system for the disposal or purification of sewage, the corporation or municipality owning or operating waterworks or sewerage systems shall, at its own expense, comply with such orders and regulations in a reasonable length of time: *Provided*, That all proposed changes shall first be approved by the State health officer.

243. Every cistern used for drinking water shall be provided with a rain-water cut-off or any simple device which will deflect the first washings of the roof and prevent the introduction of impurities into the cistern.

[DISPOSAL OF GARBAGE AND REFUSE. REG. BD. OF H., MAY 16, 1913.]

268. All dead animals and all decomposed animal matter in any city shall be deodorized and immediately removed to dump grounds provided by the municipality, and there buried at least 3 feet underground or incinerated.

269. The dump grounds so used shall be so located and of such a character as not to contaminate any domestic or public water supply either by overflow or percolation.

[DISPOSAL OF BODIES OF DEAD ANIMALS. REG. BD. OF H., MAY 16, 1913.]

274. No carcass of any dead animal, except when the same is killed for food, shall be left unburied in the State of Arkansas, nor shall it be thrown into any stream, lake, pond, well, or other body of water therein.

CALIFORNIA.

[REVISED CIVIL CODE, 1915.]

3479. *Definition of nuisance.*—Anything which is injurious to health, or is indecent or offensive to the senses, or an obstruction to the free use of property so as to interfere with the comfortable enjoyment of life or property, or

unlawfully obstructs the free passage or use in the customary manner of any navigable lake, or river, bay, stream, canal, or basin * * * is a nuisance.

3480. *Public nuisance.*—A public nuisance is one which affects at the same time an entire community or neighborhood or any considerable number of persons, although the extent of the annoyance or damage inflicted upon individuals may be unequal.

3484. *Abatement does not preclude action.*—The abatement of a nuisance does not prejudice the right of any person to recover damages for its past existence.

3490. *Lapse of time does not legalize public nuisance.* No lapse of time can legalize a public nuisance amounting to an actual obstruction of public right.

3491. *Remedies against public nuisance.*—The remedies against a public nuisance are: (1) Indictment or information; (2) a civil action; or (3) abatement.

3493. *When individual can maintain action.*—A private person may maintain an action for a public nuisance, if it is specially injurious to himself, but not otherwise.

[REVISED PENAL CODE, 1915.]

19. *Punishment of misdemeanor, when not otherwise prescribed.*—Except in cases where a different punishment is prescribed by this code, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding six months, or by a fine not exceeding $500, or by both.

347. *Willfully poisoning springs, etc.*—* * * Every person who willfully poisons any spring, well, or reservoir of water, is punishable by imprisonment in the State prison for a term not less than 1 nor more than 10 years.

370. *Definition of public nuisance.*—Anything which is injurious to health, or is indecent, or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property by an entire community or neighborhood, or by any considerable number of persons, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, or river, bay, stream, canal, or basin, * * * is a public nuisance.

371. *Unequal damage.*—An act which affects an entire community or neighborhood, or any considerable number of persons, as specified in the last section, is not less a nuisance because the extent of the annoyance or damage inflicted upon individuals is unequal.

372. *Maintaining public nuisance a misdemeanor.*—Every person who maintains or commits any public nuisance, the punishment for which is not otherwise prescribed, or who willfully omits to perform any legal duty relating to the removal of a public nuisance, is guilty of a misdemeanor.

373a. *Refusal to abate public nuisance after notice.*—Every person who maintains, permits, or allows a public nuisance to exist upon his or her property or premises, and every person occupying or leasing the property or premises of another who maintains, permits, or allows a public nuisance to exist thereon, after reasonable notice in writing from a health officer or district attorney to remove, discontinue, or abate the same has been served upon such person, is guilty of a misdemeanor, and shall be punished accordingly; and the existence of such nuisance for each and every day after the service of such notice shall be deemed a separate and distinct offense, and it is hereby made the duty of the district attorney to prosecute all persons guilty of violating this section by continuous prosecutions until the nuisance is abated and removed.

374. *Depositing dead animals in streams, etc.*—Every person who puts the carcass of any dead animal or the offal from any slaughter pen, corral, or butcher shop into any river, creek, pond, reservoir, stream, * * * and every

person who puts any water-closet or privy, or the carcass of any dead animal, or any offal of any kind, in or upon the borders of any stream, pond, lake, or reservoir from which water is drawn for the supply of any portion of the inhabitants of this State, so that the drainage of such water-closet, privy, carcass, or offal may be taken up by or in such stream, pond, lake, or reservoir; or who allows any water-closet or privy, or carcass of any dead animal, or any offal of any kind, to remain in or upon the borders of any such stream, pond, lake, or reservoir within the boundaries of any land owned or occupied by him, so that the drainage from any such water-closet, privy, carcass, or offal may be taken up by or in such stream, pond, lake, or reservoir; or who keeps any horses, mules, cattle, swine, sheep, or live stock of any kind penned, corralled, or housed on, over, or on the borders of any such stream, pond, lake, or reservoir, so that the waters thereof become polluted by reason thereof; or who bathes in any such stream, pond, lake, or reservoir; or who by any other means fouls or pollutes the waters of any such stream, pond, lake, or reservoir, is guilty of a misdemeanor, and upon conviction thereof shall be punished as prescribed in section 377.

374a. *Unlawful to dump garbage, etc., in navigable waters or in the Pacific Ocean.*—Any person who places, deposits, or dumps any garbage, swill, refuse, cans, bottles, paper, or vegetable matter, or the carcass of any dead animal, or the offal from any slaughter pen or butcher shop, or any trash or rubbish in or upon the navigable waters of this State, or who places, deposits, or loads the same upon any scow, barge, float, hulk, or any steam or sailing vessel, or any vessel of any kind, with intent that the same shall be dumped or deposited therefrom in or upon any of the navigable waters of this State, or of the Pacific Ocean without the State, at any point therein, within 20 miles of any point on the coast line of the State; and any captain or other person in charge of any scow, barge, float, hulk, or any steam or sailing vessel, or any vessel of any kind, who permits the same to be loaded with any garbage, swill, refuse, cans, bottles, paper, or vegetable matter, or the carcass of any dead animal, or the offal from any slaughter pen or butcher shop, or any trash or rubbish, with intent that the same shall be dumped or deposited therefrom in or upon any of the navigable waters of this State, or of the Pacific Ocean without the State, at any point therein, within 20 miles of any point on the coast line of the State, is guilty of a misdemeanor, and no scow, barge, float, hulk, or any steam or sailing vessel, or any vessel of any kind, upon which any garbage, swill, refuse, cans, bottles, paper, or vegetable matter, or the carcass of any dead animal, or the offal from any slaughter pen or butcher shop, or any trash or rubbish, has been loaded with the intent that the same shall be dumped or deposited therefrom upon any of the waters of the Pacific Ocean where permitted by this section, shall leave any point within the State unless it shall carry for the entire trip an inspector appointed by the State board of health, or where such point of departure is within a municipality, then by such municipality, and it shall be the duty of such inspector to enforce the provisions of this section, and the captain or other person in charge of any such scow, barge, float, hulk, steam, sailing, or other vessel so leaving without carrying such inspector during the entire trip is guilty of a misdemeanor: *Provided, however*, That this act shall not be construed to affect the discharge of any sewer system.

377b. *Violation of rules of State board of health relating to pollution of water.*—Any person who shall violate or refuse or neglect to conform to any sanitary rule, order, or regulation prescribed by the State board of health for the prevention of the pollution of springs, streams, rivers, lakes, wells, or other

waters used or intended to be used for human or animal consumption shall be guilty of a misdemeanor.

377c. *Violation of rules of State board of health as to pollution of ice.*—Any person who shall violate or refuse or neglect to conform to any sanitary rule, order, or regulation prescribed by the State board of health for the prevention of the pollution of ice or the sale or disposition of polluted ice offered, kept, or intended for public use or consumption, shall be guilty of a misdemeanor.

592. *Placing filth in canals, etc.*—Every person * * * who shall empty or place, or cause to be emptied or placed, into any such canal, ditch, flume, or reservoir [used for holding or conveying water for manufacturing, agricultural, mining, irrigating, generation of power, or domestic uses] any rubbish, filth, or obstruction to the free flow of the river, is guilty of a misdemeanor.

607. *Plowing up soil in bed or on sides of watercourse.*—Every person * * * who, between the 1st day of October and the 15th day of April of each year, plows up or loosens the soil in the bed or on the sides of any natural watercourse or channel, without removing such soil within twenty-four hours from such watercourse or channel; or who, between the 15th day of April and the 1st day of October of each year, shall plow up or loosen the soil in the bed or on the sides of such natural watercourse or channel, and shall not remove therefrom the soil so plowed up or loosened before the 1st day of October next thereafter, is guilty of a misdemeanor, and upon conviction, punishable by a fine not less than $100 and not exceeding $1,000, or by imprisonment in the county jail not exceeding two years, or by both: *Provided*, That nothing in this section shall be construed so as to in any manner prohibit any person from digging or removing soil from any such watercourse or channel, for the purpose of mining.

612. *Depositing sawdust, etc., in Humboldt Bay.*—Every person who throws, deposits, or permits another in his employ to throw or deposit, any sawdust, slabs, or refuse lumber, in any place where it may be carried or fall into the waters of Humboldt Bay, without first having constructed piers, bulkheads, dams, or other contrivances, approved by the board of supervisors of Humboldt County, to prevent the same from escaping into the channels of such bay, is guilty of a misdemeanor.

631. *Use of poison in taking fish.*—Every person who takes, kills, or destroys * * * by the use of any poisonous substance, any of the birds or animals mentioned in this chapter [includes fish], or who transports, buys, sells, or gives away, offers or exposes for sale, or has in his possession, any of the said birds or animals that have been taken, killed, or captured * * * by the use of any poisonous substance, whether taken in the State of California or shipped into the State from any other State, Territory, or foreign country, is guilty of a misdemeanor. * * *

631a. *Penalty.*—Every person found guilty of a violation of any of the provisions of section * * * 631, must be fined in a sum not less than $25 nor more than $500 or imprisonment in the county jail of the county in which the conviction shall be had not less than 25 days nor more than 150 days, or by both such fine and imprisonment.

635. *Discharging petroleum, acid, and other trade wastes into waters.*—Every person * * * who causes to be discharged or deposited, or suffers or permits to be discharged or deposited, or to pass, or who places where it can pass, in or into any of the waters of the State any pretroleum, acid, coal or oil tar, lampblack, analine, asphalt, bitumen, or residuary product of pretroleum, or carbonaceous material, or substance, or any refuse, liquid or solid from any oil refinery, gas house, tannery, distillery, chemical works, mill, or factory of any kind, or any sawdust, shavings, slabs, edgings, or any factory refuse,

or any lime, any cocculus indicus, or any slag, or any other substance or material deleterious to fish or plant life is guilty of a misdemeanor and is punishable by a fine of not less than $200 or by imprisonment in the county jail of the county in which said conviction shall be had not less than 50 days nor more than 150 days, or by both such fine and imprisonment; and all fines and forfeitures imposed or collected for any violation of the provisions of this section shall be paid into the State treasury to the credit of the fish and game preservation fund.

[REVISED POLITICAL CODE, 1915.]

2979. *Regulations of State board of health.*—It [State board of health] shall examine and have power to prevent the pollution of sources of public domestic water and ice supply. * * * It shall have power to adopt and enforce rules and regulations for the execution of its duties under this section. * * *

[GENERAL LAWS, 1915, ACT NO. 2830.[1]]

SECTION 1. *Title.*—This act shall be known as the public-health act and its provisions are to be liberally construed, with a view to effect its purpose of preventing by uniform measures the spread of contagious, infectious, and communicable diseases and to preserve and promote the health of the people of the State. Its provisions are not intended to repeal or supersede any statutes of the State now in force which are promotive of the general health and not in conflict with or repugnant to its provisions, but they shall be deemed supplemental to such statutes; and where the provisions of this act are not in conflict with and repugnant to such statutes they shall be construed consistently therewith and as continuations thereof.

SEC. 2 (as amended by Statutes, 1917, chap. 600). *Depositing of sewage, etc., in streams.*—It shall be unlawful to discharge, drain, or deposit, or cause or suffer to be discharged, drained or deposited, any sewage, garbage, feculent matter, offal, refuse, filth, or any animal, mineral, or vegetable matter or substance, offensive, injurious, or dangerous to health, into any springs, streams, rivers, lakes, tributaries thereof, wells or other waters used or intended to be used for human or animal consumption or for domestic purposes, or to maintain a sewer farm or to erect, construct, excavate, or maintain, or cause to be erected, constructed, excavated, or maintained, any privy, vault, cesspool, sewage treatment works, sewer pipes or conduits, or other pipes or conduits, for the treatment and discharge of sewage or sewage effluents or impure waters, gas, vapors, oils, acids, tar, or any matter or substance offensive, injurious, or dangerous to health, whereby the same shall overflow lands or shall empty, flow, seep, drain, condense into or otherwise pollute or affect any waters intended for human or animal consumption or for domestic purposes, or any of the salt waters within the jurisdiction of this State; or to add to, modify or alter any of the plant, works, system thereof or manner or place of discharge or disposal; or to erect or maintain any permanent or temporary house, camp, or tent, so near to such springs, streams, rivers, lakes, tributaries, or other sources of water supply, as to cause or suffer the drainage, seepage, or flow of impure waters, or any other liquids, or the discharge or deposit therefrom of any animal, mineral, or vegetable matter, to pollute such waters without a permit from the State board of health as hereinafter provided.

[1] Statutes, 1907, p. 893, as amended by Statutes, 1911, p. 565, and 1913, p. 796.

It shall also be unlawful for the owner, tenant, lessee, or occupant of any house boat or boat intended for or capable of being used as a residence, house, dwelling or habitation, or for the agent of such owner, tenant, lessee or occupant to moor or anchor the same or permit the same to be moored or anchored in or on any river or stream, the waters of which are used for drinking or domestic purposes by any city, town, or village within a distance of two miles above the intake or place where such city, town, or village water system takes water from such river or stream; *Provided, however*, That in the transportation of any such house boat on any such river or stream nothing herein contained shall prevent the owner, agent, tenant or occupant of such house boat from mooring or anchoring the same when necessary within the limits herein fixed and established; *Provided*, such house boat shall not remain moored or anchored within such limits for a longer period than one day.

SEC. 3 (as amended by Stats., 1917, chap. 600). *Petition for permission to discharge sewage, etc., into streams.*—Whenever any county, city and county, city, town, village, district, community, institution, person, firm or corporation shall desire to deposit or discharge, or continue to deposit or discharge, into any stream, river, lake, or tributary thereof, or into any other waters used or intended to be used for human or animal consumption or for domestic purposes, or into or upon any place the surface or subterranean drainage from which may run or percolate into any such stream, river, lake, tributary, or other waters, any sewage, sewage effluent, or other substance by the terms of section 2 of this act forbidden so to be deposited or discharged, or whenever any such county, city and county, city, town, village, district, community, institution, person, firm, or corporation shall desire to deposit or discharge, or continue to deposit or discharge, any sewage, sewage effluent, trade wastes or any animal, mineral, or vegetable matter or substance, offensive, injurious or dangerous to health, in any of the salt waters within the jurisdiction of this State, or to maintain a sewer farm or to permit the overflow of sewage onto any land whatever, or shall desire to erect, construct, excavate, or maintain any privy, vault, cesspool, sewage-treatment works, sewer pipe or conduits, or other pipes or conduits for the treatment and discharge of sewage, sewage effluents, or any matter offensive, injurious, or dangerous to the health, or shall desire to add to, modify, or alter any of the plant, works, or system or manner or place of discharge or disposal, he or it shall file with the State board of health a petition for permission so to do, together with a complete and detailed plan, description, and history of the existing or proposed works, system, treatment plant, and of such proposed addition to, modification, or alteration of any of the plant, works, system, or manner or place of discharge or disposal, such plans and general statement to be in such form and to cover such matters as the State board of health shall prescribe. Thereupon, a thorough investigation of the proposed or existing works, system, and plant, and all circumstances and conditions by it deemed to be material, shall be made by the State board of health. As a part of such investigation, and after 10 days' notice by mail to the petitioner, a hearing or hearings may be had before said board or an examiner appointed by it for the purpose. At such hearing or hearings witnesses who testify shall be sworn by the person conducting the hearing, and evidence, oral and documentary, may be required, a record of which shall be made and filed with said board. Upon completion of such investigation said board—

(*a*) If it shall determine as a fact that the substance being or to be discharged or deposited is such that under all the circumstances and conditions it may so contaminate or pollute such stream, river, lake, tributary, or other waters or lands on which it may be discharged, deposited, or caused to overflow, as to

endanger the lives or health of human beings or animals, or to constitute a nuisance, or does or may constitute a menace to public health or a nuisance, or that under all the circumstances and conditions it is not necessary so to dispose of such substance, the State board of health shall deny the prayer of such petition, and shall order petitioner to make such changes as the said State board of health shall deem proper for the purpose of this act. The State board of health may order the appointing of a competent person, to be approved by said board, and to be paid by said petitioner, who shall take charge of and operate such plant or system so as to secure the results demanded by the State board of health; and said board may order such repair, alteration, or additions to the existing system, plant, and works that the sewage or substance being intended to be discharged or disposed of shall not contaminate or pollute streams or other water supplies, or endanger the lives, health, or comfort of human beings or animals; and said board may order such changes of method, manner, and place of disposal and the installation of such treatment works that streams and other water supplies will not be polluted or contaminated and the works and disposal shall not constitute a menace to health of human beings or animals, or a nuisance; which orders shall designate the period within which the desired charges [changes] are to be made: *Provided, however*, That a temporary permit may be issued by the State board of health for said period to permit compliance with such order or orders.

(*b*) If it shall determine, as a fact, that the substance being or to be discharged or deposited is not such that under all the circumstances and conditions it will so contaminate or pollute such stream, river, lake, tributary, or other waters, as to endanger the lives or health of human beings or animals, or to constitute a nuisance, and that under all the circumstances and conditions it is necessary so to dispose of such substance, it shall grant to petitioner a permit authorizing petitioner so to deposit or discharge or to continue to deposit or discharge such substance: *Provided, however*, That such permit shall not be construed to permit any act forbidden by any provision of the laws of this State relative to the preservation or propagation of fish or game, or relative to the deposit of débris into the streams of the State, or relative to the obstruction of navigation: *And provided further*, That all permits issued hereunder shall be revocable by said board at any time or subject to suspension if said board shall determine, as a fact, that the substance discharged or deposited by virtue thereof causes or may cause a contamination or pollution of waters or land that does or may endanger the lives or health of human beings or animals, or does or may constitute a nuisance: *And provided, also*, That nothing contained in this act shall be construed as limiting or denying the power of any incorporated city, city and county, town, or village to declare, prohibit, and abate nuisances, or as limiting or denying the power of the State board of health to declare or abate nuisances.

The State board of health and its inspectors shall at any and all times have full power and authority to, and shall be permitted to, enter into and upon any and all places, inclosures, and structures for the purpose of making, and to make, examinations and investigations to determine whether any provision of this act is being violated. Whenever any petitioner shall be granted any permit by said board and under the provisions of this act, such petitioner shall furnish to said board upon demand a complete report upon the condition and operation of the system, plant or works, which report shall be made by some competent person designated for the purpose by said board, and at the sole cost and expense of the holder of the permit.

Any county, city and county, city, town, village, district, community, institution, person, firm, or corporation, who shall deposit, discharge or continue to

deposit or discharge, into any stream, river, lake, or tributary thereof, or into any other waters, used or intended to be used for human or animal consumption or for domestic purposes, or into or upon any place the surface or subterraneau drainage from which may run or percolate into any such stream, river, lake, tributary or other waters, or into any of the salt waters, or lands, within the jurisdiction of this State, any sewage, sewage effluent, or other substance by the terms of section 2 of this act forbidden to be so deposited or discharged, without having an unrevoked permit so to do, as in this act provided, may be enjoined from so doing by any court of competent jurisdiction at the suit of any person or municipal corporation whose supply of water for human or animal consumption or for domestic purposes is or may be affected, or by the State board of health.

Anything done, maintained, or suffered, in violation of any of the provisions of section 2 or section 3 of this act shall be deemed to be a public nuisance, dangerous to health, and may be summarily abated as such.

Every county, city and county, city, town, village, district, community, institution, firm, corporation, or person, or any officer, employee, or agent thereof upon whom the duty to act is cast, who shall violate any provision or part thereof of section 2 or 3 of this act, or who shall fail to obey, observe or comply with any direction, order, requirement or demand or any part or provision thereof of the State board of health, or who aids or abets any such county, city and county, city, town, village, district, community, institution, firm, corporation, or person, or any officer, employee or agent thereof in any failure to obey or comply with the provisions of this act or the orders of the State board of health as provided in this act, shall become liable for and forfeit to the State of California the penal sum of not more than $1,000 to be fixed by the court for each and every offense. The continued existence of any violation of this act for each and every day beyond the time stipulated for compliance with any of its provisions or of any order of the State board of health as provided herein shall constitute a separate and distinct offense. All penalties are to be recovered by the State in civil action brought by the State of California and such penalties when collected shall be paid into the general fund of the State treasury.

Every officer, agent, or employee of any county, city and county, city, town, village, district, community, institution, firm, corporation, or person who shall violate or fail to comply with any of the provisions of section 2 or section 3 of this act or with the order or orders of the State board of health or any part thereof, or who aids or abets in any failure to observe and comply with any such provision, order, or part thereof, is guilty of a misdemeanor and is punishable by a fine not exceeding $1,000 or by imprisonment in the county jail not exceeding one year or by both such fine and imprisonment, for each offense. Each day's violation of this provision shall constitute a separate and distinct offense.

SEC. 4. *Pollution by live stock.*—It shall be unlawful to cause or permit any horses, cattle, sheep, swine, poultry, or any kind of live stock or domestic animals, to pollute the waters, or tributaries of such waters, used or intended for drinking purposes by any portion of the inhabitants of this State.

SEC. 5. *Bathing in streams.*—No person shall bathe or wash clothes in any spring, stream, river, lake, reservoir, well, or other waters which are used or intended for drinking purposes by the inhabitants of the vicinage or of any city, city and county, or town of this State.

SEC. 6. *Ice, pollution of.*—Ice offered or intended for public use or consumption shall be kept or stored in clean places free from all filth, offal, refuse, and polluted waters, and separate and removed from contact with animal or vegetable matter, and not in proximity to any cesspool, privy vault, or sewer,

nor in places where such ice may be subject to contamination from, or the action of acids, oils, noxious, offensive, or injurious gases, smoke or vapors, and all ice kept or stored in violation of this section shall be deemed polluted ice and not fit for human consumption; and it shall be unlawful to sell, offer for sale, or store for sale such polluted ice.

SEC. 7. *Ice from breweries, etc., not to be sold.*—It shall be unlawful to sell, offer, or keep for sale for public use or consumption, ice which shall have been used for the cooling of malt, vinous, or spirituous liquors, or for the refrigeration of butter, milk, meat, or any animal or vegetable matter or substances, or which shall have been taken from any asylum, hospital, sanitarium, sick room, slaughterhouse, or any place where human or animal remains have been kept or deposited.

SEC. 8. *Transportation of ice.*—In the transportation or carriage of ice intended for public use or consumption care shall be taken to prevent contact with filth, offal, and other refuse, and contamination from animal and vegetable matter, and from offensive and noxious oils, acids, and other substances injurious, dangerous, or offensive to health.

SEC. 9. *Polluted ice.*—No person, firm, company, or corporation shall make or permit to be made, or offer or permit to be offered for sale for public use or consumption, any ice manufactured from impure or polluted water, or natural ice cut or taken from any corrupt or impure waters or water source; nor taken or manufactured from any waters or source of water supply after notice from the State board of health, or its secretary, that such waters are impure or polluted.

SEC. 10. *Inspection of ice plants.*—In the interest of the public health every health officer or health inspector, upon proper demand and notice of his authority, shall be permitted, during office hours, to enter and inspect the works, premises, sources of supply, and places of storage of any person, firm, company, or corporation, maintaining, selling, or offering for sale, water or ice for human use or consumption, and it shall be unlawful for any person, firm, company, or corporation to refuse to permit a reasonable inspection or investigation of such works and premises or the ice and water kept or stored therein, or to impede or obstruct such officer during such investigation.

* * *

[GENERAL LAWS, 1915, ACT No. 4848B.[1]]

SECTION 1 (as amended by Stats., 1917, p. 1562). *Unlawful to supply polluted water.*—It shall be unlawful for any person, firm, corporation, public utility, municipality, or other public body or institution to furnish or supply or to continue to furnish or supply water used or intended to be used for human consumption or for domestic uses or purposes which is impure, unwholesome, unpotable, polluted, or dangerous to health, to any person in any county, city and county, municipal corporation, village, district, community, hotel, temporary or permanent resort, institution, or industrial camp.

SEC. 2 (as amended by Stats. 1917, p. 1562). *Petition for furnishing water, etc.*—Whenever any person, firm, corporation, public utility, municipality, or other public body or institution shall desire to furnish or supply, or to continue to furnish or supply water for domestic uses or purposes to any person in any district, community, hotel, temporary or permanent resort, institution, or industrial camp, or shall desire to install, add to, modify, or alter any of the plant, works, system, or sources of supply, it or he shall file as herein provided with the State board of health a petition for permission so to do, together with complete plans and specifications and a statement containing a

[1] Statutes, 1913, p. 793, as amended by 1915, p. 1282, and 1917, p. 1562.

general description and history of the existing or proposed water-supply system of proposed changes therein showing the geographical location thereof with relation to the source of the water supply and all the sanitary and health conditions surrounding and affecting said supply and the works, system, and plant, such plans, specifications, and general statement to be in such form and to cover such matters as the State board of health shall prescribe. Thereupon a thorough investigation of the proposed or existing works, system, plant, water supply, and all other circumstances and conditions by it deemed to be material must be made by the State board of health: *And provided, however*, That no person, firm, or corporation supplying water for domestic purposes or use on his or its private property upon which there is no industrial camp, hotel, temporary or permanent resort using said water, or supplying less than 200 service connections, shall be required to apply for a permit under the provisions of this section, except upon formal complaint filed with the State board of health.

As a part of such investigation, and after 10 days' notice by mail to the petitioner, a hearing or hearings may be had before said board or an examiner appointed by it for the purpose. At such hearing or hearings witnesses who testify shall be sworn by the person conducting the hearing, and evidence, oral and documentary, may be received, a record of which shall be made and filed with said board. Upon completion of such investigation said board:

(*a*) If it shall determine as a fact that the water being furnished or to be furnished or supplied is such that under all the circumstances and conditions it is impure, unwholesome, or unpotable, or may constitute a menace or danger to the health or lives of human beings, or that under all the circumstances and conditions the existing or proposed works, system, plant, or water supply or proposed modifications therein are unhealthful or insanitary, or not suited to the production and delivery of healthful, pure, and wholesome water, said board shall order the petitioner to make such changes as it deems necessary to secure a continuous supply of pure, wholesome, potable, and healthful water. Said board may order the appointing of a competent person, to be approved by the State board of health and paid by said petitioner, who shall take charge of and operate such plant or system so as to secure the results demanded by the State board of health; and it may order such repair, alteration, or addition to the existing system, plant, and works that the water furnished or supplied shall at all times be pure, wholesome, potable, and shall not endanger the lives or health of human beings; and said board may order such changes of source of the water supply or installation of purification and refining works and such other measures as shall insure a continuous supply of pure, wholesome, and potable water which shall not endanger the lives and health of human beings; which order shall designate the period within which the required changes are to be made: *Provided, however*, That a temporary permit may be issued by the State board of health for said period to permit the petitioner to comply with such order or orders.

(*b*) If it shall determine, as a fact, that the water being furnished or supplied to such human beings is such, that under all the circumstances and conditions, it is pure, wholesome, and potable and does not endanger the lives or health of human beings, it shall grant to petitioner a permit authorizing petitioner to furnish or continue to furnish or supply such water to such human beings: *Provided, however*, That all permits issued hereunder shall be revocable or subject to suspension by said board at any time that it shall determine, as a fact, that the water being supplied or furnished is or may become impure, unwholesome or unpotable or does or will endanger the lives or health of human beings. The State board of health and its inspectors shall, at any and all reasonable times, have full power and authority to, and shall be permitted to

enter into and upon any and all places, property, inclosures, and structures for the purpose of making and to make examinations and investigations to determine whether any provision of this act is being violated. The holder of any permit granted by said board under the provisions of this act may, at any time, by order of said board be required to furnish to said board, upon demand, a complete report upon the condition and operation of the water supply, plant, works, or system owned, operated, or controlled by it, which report shall be made by some competent person designated for the purpose by said board, and at the sole cost and expense of the holder of the permit. Any person, firm, corporation, public utility, municipality or other public body or institution who shall furnish or supply or continue to furnish or supply water used or intended to be used for human consumption or for domestic uses or purposes, or shall install additions to, modifications, or alterations in any of the existing plant, works, system, or sources of supply without having an unrevoked permit from the State board of health so to do, as in this act provided, may be enjoined from so doing by any court of competent jurisdiction, at the suit of any person or persons, firm, corporation, municipal or other public corporation whose supply of water for human consumption or for domestic uses or purposes is taken or received from or supplied or furnished by any such water furnishing or distributing person, firm, corporation, public utility, or municipality or other public body or institution, or it or he may be enjoined at the suit of the State board of health in the same manner. Anything done, maintained, or suffered in violation of any of the provisions of this act shall be deemed to be a public nuisance, dangerous to health, and may be summarily abated in the manner provided by law, and it shall be the duty of all and every public officer or officers, body or bodies lawfully empowered so to do to immediately abate the same.

Every person, firm, corporation, public utility, municipality, or other public body or institution, or officer, employee or agent thereof upon whom the duty to act is cast, and every person who shall violate any provision or part thereof of this act, or who shall fail to obey, observe, or comply with any direction, order, requirement, or demand, or any part or provision thereof, of the State board of health, or who procures, aids, or abets any such person, firm, corporation, public utility, municipality, or other public body or institution, or officer or employee or agent thereof, in any failure to obey or comply with the provisions of this act or the orders of the State board of health as provided in this act, shall become liable for and forfeit to the State of California the penal sum of not more than $1,000 for each separate offense. The continued existence of any violation of this act for each and every day beyond the time stipulated for compliance with any of its provisions or of any order of the State board of health as provided herein shall constitute a separate and distinct offense. All penalties are to be recovered by the State in civil action brought by the State of California and such penalties when collected shall be paid into the general fund of the State treasury.

Every officer, agent, or employee of any person, firm, corporation, public utility, municipality, or other public body or institution or person who shall violate or fail to comply with any of the provisions of this act or the order of the State board of health or any part thereof, or who procures, aids, or abets in any failure to observe and comply with any such provision, order, or part thereof, is guilty of a misdemeanor and is punishable by a fine not exceeding $1,000 or by imprisonment in the county jail not exceeding one year or by both such fine or imprisonment, for each offense. Each day's violation of this provision shall constitute a separate and distinct offense.

[GENERAL LAWS, 1915, ACT No. 4368.[1]]

SECTION 1. *Privies forbidden.*— * * * It shall be unlawful for any person to erect, construct, excavate, or maintain on or near the banks of any river or stream and within 2 miles above the intake of any water supply used for domestic or drinking purposes in any city, town, or village any privy, vault, cesspool, sewer pipe, or conduit which shall cause or suffer to be discharged into said stream or river any sewage, garbage, feculent matter, offal, filth, refuse, or any animal, mineral, or vegetable matter, or substance offensive, injurious, or dangerous to health.

SEC. 2. *Penalty.*—Any person who violates any of the provisions of section 1 of this act is guilty of a misdemeanor. Each day's violation of any of the provisions of said section 1 shall constitute a separate and distinct offense.

SEC. 3. *Nuisances.*—Any privy, vault, cesspool, sewer pipe, or conduit erected, constructed, excavated, or maintained on or near the banks of any river or stream within 2 miles above the intake of any water supply used for drinking or domestic purposes in any city, town, or village, which shall cause or suffer to be discharged therefrom sewage, garbage, feculent matter, offal, refuse, filth, or any animal, mineral, or vegetable matter or substance offensive, injurious, or dangerous to health into such river or stream, and any house boat or boat intended for or capable of being used as a residence, house, dwelling, or habitation, which shall for more than one day be moored or anchored in or upon any river or stream within 2 miles above the intake of any water supply used for domestic or drinking purposes in any city, town, or village are hereby declared to be public nuisances; and it is hereby made the duty of any and all sheriffs, constables, policemen, and health officers to immediately abate said nuisance.

[STATUTES OF 1917, p. 42.]

SECTION 1. *When taking of oysters is unlawful.*—It shall be unlawful to take oysters, clams, quahaugs, mussels, or other shellfish used or intended to be used for human consumption from any tidal waters, flats, areas, or sources from which the taking of such shellfish shall be determined to be a menace to health as hereinafter provided.

SEC. 2. *Examination of tidal waters, etc., by State board of health.*—The State board of health may and is hereby empowered to examine any tide waters, flats, areas, or sources from which oysters, clams, quahaugs, mussels, or other shellfish may be taken, and to determine whether such waters, flats, areas, or sources are subject to sewage contamination, and to determine whether the taking of such shellfish from such waters, flats, areas, or sources does or may constitute a menace to the lives and health of human beings. Upon the determination by said State board of health that such waters, flats, areas, or sources are or may be subject to sewage contamination, and that the taking of shellfish therefrom does or may constitute a menace to the lives and health of human beings, said board shall ascertain as accurately as may be the bounds of such contamination and shall cause the posting of notices describing the bounds of the tidal flats, waters, areas, or sources from which the taking of shellfish shall be unlawful. The fact of the posting of such notices shall be published once a week for four successive weeks in some newspaper of general circulation, published in the county in which such waters, flats, areas, or sources are situated, if there be one, and if there be none, then in a newspaper published in an adjoining county.

[1] Statutes of 1909, p. 140.

SEC. 3. *Enforcement.*—It shall be the duty of the State board of health to enforce the provisions of this act and its inspectors and employees are hereby empowered to enter upon public or private property upon which shellfish may be located at all times for the purposes of this act.

SEC. 4. *Penalty.*—Any person violating any of the provisions of this act shall be guilty of a misdemeanor and upon conviction shall be punished by a fine of not less than $25 nor more than $500 or by imprisonment for a term of not more than six months, or by both such fine and imprisonment, but such penalties shall not be incurred until the fact of such prohibition shall have been published for four successive weeks, as above provided. Each day's violation shall constitute a separate and distinct offense.

[STATUTES OF 1917, p. 70.]

SECTION 1. *Swimming pools under supervision of State board of health.*—The State board of health shall have supervision over the sanitation, healthfulness, and cleanliness and safety of swimming pools, bathhouses, public swimming and bathing places, and all related appurtenances and is hereby empowered to make and enforce such rules and regulations pertaining thereto as it shall deem proper.

SEC. 2. *Permit required for operation of swimming pool.*—It shall be unlawful for any person, persons, firm, corporation, institution, or municipality in any district, town, city, county, or city and county, to construct or to add to or modify or to operate or to continue to operate any swimming pool, public bathhouse, bathing or swimming place, or any structure intended to be used for swimming or bathing purposes without an unrevoked permit so to do from the State board of health. * * *

SEC. 5. *Swimming pools operating contrary to act nuisances.*—Any swimming pool, public swimming or bathing place or places, constructed, operated, or maintained contrary to the provisions of this act are hereby declared to be public nuisances, dangerous to health. Such nuisances may be abated or enjoined in an action brought by the local or State board of health, or they may be summarily abated in the manner provided by law for the summary abatement of public nuisances dangerous to health.

SEC. 6. *Penalty.*—Any person, firm, or corporation, whether as principal or agent, employer or employee, who violates any of the provisions of this act shall be guilty of a misdemeanor, and each day that conditions or actions in violation of this act shall continue shall be deemed to be a separate and distinct offense, and for each offense, upon conviction, he shall be punishable by a fine of not less than $25 nor more than $500, or shall be imprisoned in the county jail for a term not exceeding six months, or by both such fine and imprisonment.

COLORADO.

[COURTRIGHT'S COLORADO STATUTES, 1918.]

1816. *Polluting watercourses.*—If any person * * * shall in anywise pollute or obstruct any watercourse, lake, pond, marsh, or common sewer, or continue such obstruction or pollution so as to render the same offensive or unwholesome to the county, town, village, or neighborhood thereabouts; every person so offending shall, upon conviction thereof, be fined not exceeding $300; and every such nuisance may, by order of the district court before whom the conviction may take place, be removed and abated by the sheriff of the proper county, and any inquest and judgment thereon had under the provisions of any law authorizing a writ of ad quod damnum shall be no bar to a prosecution under this section.

1817. *Putting refuse matter from slaughterhouses, etc., into streams.*—If any person or persons shall hereafter throw or discharge into any stream of [or] running water, or into any ditch or flume in this State, any obnoxious substance, such as refuse matter from slaughterhouse or privy, or slops from eating houses or saloons, or any other fleshy or vegetable matter which is subject to decay in the water, such person or persons shall, upon conviction thereof, be punished by a fine not less than $100 nor more than $500 for each and every offense so committed.

1818. *Unlawful to flow oil into stream.*—If any person or persons, corporation or corporations, shall hereafter empty or cause to be emptied, or allow the emptying or flowing of oil, petroleum, or other oleaginous substance into any of the waters of this State, or deposit or cause the same to be deposited at such distance that the same may be carried into such waters by natural causes, such person or persons, corporation or corporations, so offending shall be deemed guilty of a misdemeanor and, upon conviction thereof, shall be punished by a fine not exceeding $1,000 or imprisonment in the county jail not exceeding six months, or both such fine and imprisonment, for each such offense.

2083. *Unlawful to defile waters of Platte River and Bear Creek.*—It shall be unlawful for any person to deposit into the channel of the South Platte River or Bear Creek, or any of their tributaries above the mouth of Clear Creek, or between or upon the banks of said streams, any unwholesome matter or substance whatever tending to the defilement or pollution of the water of said streams, or to allow the drainage from any sewer, drain, or cesspool to drain into or percolate into said streams or their tributaries, or any of them, or to permit any dead animal or decaying vegetable matter to be placed or left within a distance of 300 feet of the banks of any said streams or their tributaries, or to do any other act or thing whereby the water of said streams might become polluted or unfit or unwholesome for human consumption: *Provided*, That the disturbances of water by placer mining or tailings from ore reduction mills flowing into any of said streams or tributaries shall not be construed as defilement or pollution of the water thereof.

2084. *City of Denver given jurisdiction over streams.*—The city and county of Denver is hereby given jurisdiction over said streams to protect their purity under section 1 of this act [sec. 2083 above], and is hereby authorized to provide by ordinance for the patrol of said streams and for the punishment of offenders against the provisions of this act.

2758. *Use of poison for taking fish.*—No * * * poisonous or stupefying substance whatever shall be used in the taking or killing of any fish, nor placed in any waters containing fish * * *.

2815. *Poisonous substances, etc., to be destroyed.*—Every * * * poisonous or stupefying substance or device used or intended for use in taking or killing game or fish in violation of this act [secs. 2814–2832] and * * * kept or found in or upon any of the waters in this State or upon the shores thereof * * * is hereby declared to be a public nuisance and may be abated and summarily destroyed by any person, and it shall be the duty of every officer authorized to enforce this act to seize and summarily destroy the same, and no prosecution or suit shall be maintained for such destruction * * *.

2820. *Sawdust, tailings, etc., not to be allowed to run into streams containing fish.*—No sawdust, tailings, or other deleterious or poisonous substance shall be allowed to run or pass into or pollute any public waters containing fish, or deposited or left where it may be carried by natural causes into such waters, in such quantities as to destroy or be detrimental to the fish or spawn therein, except as hereinafter provided.

2822. *Action to abate nuisance of pollution of streams.*—Whenever any such * * * pollution is alleged to exist, the commissioner, any citizen of the State, or the owner or operator of such * * * industry, may file a petition in the district court of the county in which the * * * pollution is alleged to exist or originate, or into which any of the polluted water flows, for the purpose of having an equitable determination of the fact, nature, and extent of such an alleged * * * pollution and the remedy to be applied, if any, and a temporary injunction may issue upon notice, if the fact of * * * pollution be evident and the necessity urgent. Issues shall be made up as in other civil actions.

2823. *By whom action may be brought, etc.*—The action may be brought by the [game and fish] commissioner or a citizen of the State in the name of the people of the State on the relation of such person, but no such action shall be brought by a citizen without the consent of the commissioner, the attorney general, or the district attorney of the district. * * *

2824. *When owner brings action.*—If the action is brought by the owner or operator, the people of the State shall be made defendants, and service of the summons shall be made upon the commissioner, and a crosss petition may be filed with the same effect as an original petition.

2826. *Court shall determine controversy.*—On final hearing the court shall, without the intervention of a jury, determine if such * * * pollution exists and, if so, the cause, nature, and extent thereof, the injurious effect, if any, upon the fish and their propagation, the means adopted, if any, by such owner or operator to obviate or prevent the same, the practicability or otherwise of more efficient means to prevent injury therefrom, and any other facts necessary to form an intelligent judgment of the public necessity and importance of the industry concerned as compared with the like necessity and importance of such waters as a source of fish supply if unaffected thereby, and having due regard to the public welfare and such constitutional and legal rights as may exist, may order the adoption by the owner or operator of such means as may be reasonable and practicable to prevent or lessen the injurious effect of the same, or may * * * perpetually enjoin the operations which cause the injury, or render such other judgment as the right of the case may require. In determining the questions aforesaid the court shall not be precluded from considering the other beneficial uses to which such waters are or may be applied.

2828. *When injury is later increased or diminished.*—In the event of a change in the cause, extent, or nature of such injury, either increasing or diminishing the effect thereof, either party may at any time thereafter file a supplemental petition in the district court where the cause was tried and have such increased or diminished effect determined and the judgment modified accordingly; but the facts originally found shall not be retried upon such supplemental petition, nor shall the original judgment, whether finally rendered in such court or the supreme court, be modified or changed except as required by such changed conditions.

2832. *When enforced by criminal prosecution.*—Nothing in this division [secs. 2814–2832] shall prevent the enforcement of this act by criminal prosecution in the absence of the equitable proceeding herein provided for, or during the pendency of the same, unless the court in which such equitable proceeding is pending shall for good cause shown restrain such criminal prosecution, which it may do, nor shall anything in this division affect any existing right for the prevention or redress of private injuries or wrongs.

2876 (as amended by chapter 84, Session Laws of 1913). *Penalty for use of poisonous substance in taking fish.*—Every person using * * * poisonous

or stupefying substance * * * in violation of this act [secs. 2874–2884] shall be punished by a fine of not less than $100 nor more than $500, or by imprisonment in the county jail not more than six months, or by both such fine and imprisonment.

4214. *Washing down tailings, etc.*—In no case shall any person or persons [engaged in mining] be allowed to flood the property of another person with water or wash down the tailings of his or their sluice upon the claim or property of other persons, but it shall be the duty of every miner to take care of his own tailings, upon his own property, or become responsible for all damages that may arise therefrom.

5034. *Dead animals not to be put in rivers, etc.*—If any person or persons shall put any dead animal or part of the carcass of any dead animal into any lake, river, creek, pond, * * * and if the owner or owners thereof shall knowingly permit the same to remain in any of the aforesaid places, to the injury of the health or to the annoyance of the citizens of this State, or any of them, every person so offending shall be deemed guilty of a misdemeanor, and upon conviction thereof shall forfeit and pay a sum not less than $5 nor more than $50, together with the costs of prosecution, and in default of the payment thereof shall be imprisoned in the county jail of the county in which such conviction may be had, not exceeding 10 days, to be imposed by any court of competent jurisdiction, and every 24 hours said owner may permit the same to remain after such conviction shall be deemed an additional offense against the provisions of this act, and upon conviction thereof shall forfeit and pay a further sum of not less than $10 and not more than $30, together with the costs of prosecution, to be recovered as aforesaid, and in default of the payment thereof be imprisoned as aforesaid not more than 30 days, or be punished by both such fine and imprisonment, in the discretion of the court.

6525. *Protection of water supplies of towns from pollution.*—The city council and board of trustees in towns shall have the following powers:

Sixty-eighth. They shall have power to construct or authorize the construction of * * * waterworks, without their limits, and for the purpose of maintaining and protecting the same from injury and the water from pollution, their jurisdiction shall extend over the territory occupied by such works, and all reservoirs, streams, trenches, pipes, and drains, used in and necessary for the construction, maintenance, and operation of the same, and over the stream or source from which the water is taken, for 5 miles above the point from which it is taken; and to enact all ordinances and regulations necessary to carry the power herein conferred into effect.

6811. *Board of waterworks may prevent pollution of city's water supply.*— * * * * For the purpose of maintaining and protecting * * * waterworks from injury, and the water from pollution, the jurisdiction of said board [board of waterworks of municipality] shall extend over the territory occupied by said works, and all reservoirs, streams, trenches, pipes, and drains, used in and necessary for the construction, maintenance, or operation of the same, and over the stream or source from which the water is taken for 5 miles above the point from which it is taken. It shall have power to make all needful rules and regulations concerning the use of water supplied by said waterworks, and for carrying into effect the powers herein granted.

* * *

[ACTS OF 1915, CHAP. 150.]

SEC. 3. *Examinations of samples of suspected water.*—It shall be the duty of the State chemist to make * * * sanitary chemical and bacteriological analyses of samples of water from the water supply of towns or school districts

upon the request of the authorities of the same, whenever such water supplies are suspected of being contaminated. * * *

CONNECTICUT.

[REVISED STATUTES, 1902.]

1328 (as amended by acts of 1905, chap. 38). *Pollution of water of reservoir.*—Every person * * * who shall bathe in any reservoir from which the inhabitants of any town, city, or borough are supplied with water, or in any lake, pond, or stream tributary to such reservoir, or who shall cast any filthy or impure substance into said reservoir, or any of its tributaries, or commit any nuisance in or about it or them, shall be fined not more than $100 ,or imprisoned not more than six months or both.

2514. *Pollution of streams.*—Said board [State board of health] is empowered to investigate and ascertain as far as practicable all facts in relation to the pollution of streams and natural waters of this State by artificial causes to determine the sanitary and economic effects of such pollution, may enter upon lands, buildings, and premises, as may be necessary for their investigations, may institute and conduct needful experiments pertaining thereto, and may summon witnesses, administer oaths, and hear evidence relating to such matters. Said board shall annually make a written report to the governor of its operations under this section.

2515. *Treasurer to pay on controller's warrant.*—The treasurer shall pay to said board of health for the purposes of such investigations and experiments, upon the comptroller's warrant, in such sums as the certificate of the board with proper vouchers annexed may certify, a sum not exceeding $2,500.

2528. *Jurisdiction over streams for health purposes.*—The health officer of a town, city, or borough. contiguous to any stream or body of water which is not wholly within the limits of said town, city, or borough, shall have jurisdiction over such stream or body of water and the islands situated therein.

2594. *Pollution of waters.*—Every person who shall put or leave a dead animal or carcass in a pond, spring, or reservoir, the water of which is conveyed to any building, or who shall wilfully put and leave in any of the waters of this State a dead animal, shall be fined not more than $50, or imprisoned not more than 30 days.

2595. *Penalty for polluting drinking water.*—Every person who shall put anything into a well, spring, fountain, cistern, or other place from which water is procured for drinking or other purposes, with the intent to injure the quality of said water, shall be fined not more than $500, or imprisoned not more than six months.

2596. *Analysis of water.*—Town, borough, and city health officers shall, when in their judgment health is menaced or impaired through a water supply, send, subject to the approval of the county health officer, samples of such water to the State board of health for examination and analysis, and the expense of such examination and analysis shall be paid out of the funds appropriated to said board to investigate the pollution of streams.

2597. *Cutting of ice regulated.*—Every person who shall sell or offer to sell for family, hotel, boarding-house, restaurant, or saloon use, ice cut or taken from a pond, lake, or stream other than a river, into which any sewer empties, or from such part of a river as is below and within two miles of the point where the discharge from any sewer enters such river, or ice cut from a body or stream of water within 200 feet from where any house drain enters such body or stream of water, or ice cut from any body of water or stream the

water or ice from which has been condemned as unfit for use or dangerous to public health by the local health officer of the town, city, or borough where such body of water or stream is located, or ice which has been placed in a yard, building, or cart, with ice taken from any of the foregoing sources, shall be fined $50, or imprisoned not more than 60 days, or both. Every person aggrieved by an order issued or made by a health officer under the provisions of this section may appeal, within two weeks from the date of such order, in the manner provided for appeals from the orders of town health officers.

2598. *Location of cemeteries.*—No cemetery or place of sepulture shall hereafter be located or established within one-half mile of any reservoir from which the inhabitants of a town, city, or borough are supplied with water, nor shall such reservoir be located or established within one-half mile of a cemetery or place of sepulture unless the superior court of the county wherein such cemetery or place of sepulture or reservoir is located shall, upon application and notice, find that such cemetery or place of sepulture or such reservoir so proposed to be located is of public convenience and necessity and will not be detrimental to the public health.

2599 (as amended by acts of 1909, chap. 137). *Relief from pollution by injunction.*—Whenever any land or building is so used, occupied, or suffered to remain that it is a source of pollution to any river, brook, or water which flows into any lake, pond, or water from which ice is procured for domestic use or for use as an article of merchandise, and such ice is liable to pollution therefrom, or whenever any land or building is so used, occupied, or suffered to remain that it is a source of pollution to the water stored in a reservoir used for supplying residents of a city, town, or borough with water or ice, or to any source of supply to such reservoir, or when such water or ice is liable to pollution in consequence of the use of the same, either the authorities of such town, city, or borough, or the county or town health officer, or the person, firm, or corporation having charge of such reservoir, or the right to procure ice therefrom, may apply for relief to the superior court in the county where such reservoir or water is located, and said court may make any order in the premises, temporary or permanent, which, in its judgment, may be necessary to preserve the purity of such water or ice. Such city, town, borough, or company, by its officers or agents duly appointed, or the county or town health officer, may, at all reasonable times, enter upon and inspect any premises within the watershed tributary to such water supply or waters from which such ice is procured and, if any nuisance likely to pollute such water or ice shall be found therein, such officers may abate such nuisance after reasonable notice to the owners or occupants of such premises and their refusal or neglect to abate the same, and such town, city, borough, or company shall be liable for all unnecessary or unreasonable damage done to such premises.

2600 (as amended by acts of 1903, chap. 192). *Power to take lands and streams.*—Any city, town, borough, or corporation authorized by law to supply the inhabitants of any city, town, or borough with pure water for public or domestic use may take and use such lands, springs, streams, or ponds, or such rights or interests therein, as the superior court, or any judge thereof in vacation, may, on application, deem necessary for the purposes of such supply. For the purpose of preserving the purity of such water and preventing any contamination thereof such city, town, borough, or corporation may take such lands or rights as the superior court or any judge thereof in vacation may, on application, deem necessary therefor. Compensation shall be made to all persons entitled thereto in the manner provided by section 2601.

2601 (as amended by acts of 1903, chap. 192). *Compensation for property taken.*—In all cases where the law requires compensation to be made to any

person whose rights, interests, or property are injuriously affected by said orders, such court, or judge, shall appoint a committee of three disinterested freeholders of the county who shall determine and award the amount to be paid by such authorities before such order is carried into effect.

2602. *Pollution of reservoirs, penalty.*—No person, after notice shall have been posted that any reservoir, or any lake, pond, or stream tributary thereto, is used for supplying the inhabitants of a town, city, or borough with water, shall wash any animal, clothing, or other article therein. No person shall throw any noxious or harmful substance into such reservoir, lake, pond, or stream, nor shall any person, after receipt of written notice from any county or town health officer having jurisdiction that the same is detrimental to such water supply, suffer any such substance to be placed upon land owned, occupied, or controlled by him, so that the same may be carried by rains, or freshets, into the water of such reservoir, lake, pond, stream, or drain, or allow to be drained any sewage from said land into such water. Every person who shall violate any provision of this section shall be fined not more than $100, or imprisoned not more than 30 days, or both.

2603. *Appointment of special police.*—The governor may, upon the application of such town, borough, city, or company, commission during his pleasure one or more persons who, having been sworn, may act as policemen for the purpose of preventing and abating nuisances and protecting such water supply from contamination; such policemen shall arrest without previous complaint and warrant any person for any offense under the provisions of any law for the protection of water supplies, when the offender shall be taken or apprehended in the act, or on the speedy information of others; and all persons so arrested shall be immediately presented before proper authority. Every such policeman shall, when on duty, wear in plain view a shield bearing the words "Special police" and the name of the town, city, borough, or company for which he is commissioned.

2604. *Special reports by town health officer.*—Every town health officer shall, if requested in writing by any such town, city, borough, or company, report to such town, city, borough, or company in writing every case of cholera or typhoid fever within such portion of his jurisdiction as may be designated in such request, within 12 hours after the same shall come to his knowledge or attention; and such officer shall be paid a reasonable sum for each report by the party making such request.

2605. *Power to make regulations concerning reservoirs.*—The common council of a city, or the warden and burgesses of a borough, may make, alter, and repeal ordinances to regulate and prevent fishing, trespassing, and all sorts of nuisances in and upon the reservoir property of such city or borough in whatever town said property may be situated. The violations of any such ordinance shall be a misdemeanor, for which the common council, or the warden and burgesses, as the case may be, may impose penalties and forfeitures. All such penalties and forfeitures shall be to the use of the city or borough imposing the same, and may be recovered in either a civil action brought in the name of the city or borough, or a criminal prosecution brought before any court having jurisdiction over the offense; *Provided*, That no person shall suffer both a criminal and civil prosecution for one breach of any ordinance.

2606. *Protection of reservoir property.*—The common council of any city or the warden and burgesses of any borough may appoint special constables to protect reservoir property and to execute any ordinance passed under the preceding section and the laws of the State and for that purpose such constables shall have all the powers of constables of towns.

3242 (as amended by Public Acts of 1913, chapter 198). *Places for dumping mud, etc., to be designated.*—Before any person shall engage in removing mud or refuse material by boat from any harbor wherein or south of which oyster grounds are located and designated, he shall notify the [shellfish] commissioners by a written or printed notice delivered to said commissioners at their office in New Haven, stating the time when such work will be commenced and the name of the boat or boats to be employed. Within a reasonable time after the receipt of said notice said commissioners shall designate and buoy out places off the respective towns where such deposits shall be made. No person shall deposit mud or other material except in places so designated and buoyed out, nor within a radius of 5 miles from Southwest Ledge Lighthouse, nor in any of the waters opposite the town of Branford, nor unless an agreement in writing, with security to the satisfaction of the shellfish commissioners, has been entered into for the payment of inspectors provided in section 3244 of the General Statutes, unless such material is to be dumped on a private oyster bed as provided in section 3243 of the General Statutes. Every person violating any provision of this section shall be fined not more than $500. This section shall not apply to the construction of breakwaters, docks, or any work authorized by the United States Government.

3243. *Notice to shellfish commissioners required before dumping on private oyster bed.*—Any person intending to dump material on any private oyster bed in State jurisdiction from bottom or side dumping scows shall first give reasonable notice thereof to the commissioners, designating the material and the location where it is proposed to dump the same, and said commissioners shall notify the adjoining owners that they may protest if material or place is not suitable. Every person who, having failed to give such notice, shall so dump material, shall be fined not more than $50.

3244 (as amended by Public Acts of 1913, chapter 198). *Dumping inspectors.*—Said commissioners shall appoint one or more suitable persons who shall be known as dumping inspectors, whose duty it shall be to accompany every boat, when it is employed in towing or carrying mud or other material, except that used in making oyster beds, in any of the territory mentioned in section 3242 of the General Statutes, to see that such mud or other material is properly dumped, and to report to said commissioners any violation of law in respect to such dumping. No person in charge of or employed upon such boat shall interfere with such inspector in the discharge of his duty or refuse to permit him to enter and remain upon said boat while so employed. Said inspectors shall receive a sum not exceeding $2.50 per day for such services, which shall be paid by the person or corporation by or on whose behalf such mud or material is so towed or carried. Said inspectors shall make sworn returns to said commissioners of all material taken out in boats on which they act as inspector and of the place where dumped, and no bill for services shall be paid until said sworn returns are on file in their office.

3245. *Putting mud in navigable waters.*—Every person who shall willfully deposit or assist in depositing any starfish or periwinkle in any of the navigable waters of this State or who shall dump mud or other material, except that used in making oyster beds, on any ground located and designated as oyster ground shall be fined not more than $50 or imprisoned not more than six months.

4454. *Cemeteries not to be near ice ponds.*—No cemetery or place of sepulture shall be located within 600 feet of any ice pond already located, from which the inhabitants of any town, city, or borough are supplied with ice, unless such pond is upon a higher level than such cemetery or place of sepulture; nor shall any such ice pond be located within 600 feet of any cemetery or place of sepulture unless such ice pond is upon a higher level than such

cemetery or place of sepulture, or unless the superior court of the county where such cemetery or place of sepulture or ice pond is located shall, upon application, and such notice as it may deem proper, find that such cemetery or place of sepulture or such ice pond so proposed to be located is of public convenience and necessity, and will not be detrimental to the public health. If said court shall so find, before such cemetery or place of sepulture is located, it shall appoint a committee of three disinterested persons who, after examining the premises and hearing the parties interested, shall report to the court the damages to such ice pond resulting from such location. If said report is accepted, such cemetery or place of sepulture shall not be located until said damages are paid to the owner of such pond or deposited with the treasurer of the county for his use, which shall be done within 30 days after the acceptance of said report. If said application shall be denied, the owner of the ice pond shall recover costs of the applicant, to be taxed by said court, which may issue execution therefor. This section shall not affect grounds owned by existing cemetery associations, or land contiguous to such grounds which may hereafter be taken for the enlargement thereof.

4769. *Throwing furnace refuse from a vessel into waters.*—Every proprietor or charterer of any steamer or vessel, from which any furnace refuse shall be thrown into the waters of any harbor or river in this State, shall be fined for the first offense $100, and for every subsequent offense $200.

4773. *Depositing substances in certain waters.*—Every person who shall deposit any substance, except oyster shells, in New Haven Harbor or off its mouth within 2 miles of Southwest Ledge Lighthouse, or in Bridgeport Harbor or off its mouth within 300 feet outside of the outer bar, so-called, or in the waters adjacent to said harbor below Yellow and Old Mill Bridge, or in Stamford Harbor or off its mouth inside of a direct line drawn from Captains Island Light, off Greenwich, to the buoy on Old Cow Reef, off Shippan Point, shall be fined not less $50 nor more than $500, or imprisoned not more than six months or both; but this section shall not prevent the owners of land adjacent to said harbors from building wharves therein.

4775. *Depositing substances in certain waters.*—Every person who shall deposit or assist in depositing any mud or other substance, except oyster shells or other material necessary for making oyster beds, in Norwalk Harbor, or at any place off the town of Norwalk inside of a line running due east and west from a point due south a distance of 1 mile from Green Reef Government Buoy, or who shall deposit any substance in any of said waters during the night season, shall be fined not less than $50 nor more than $500, or imprisoned not more than six months or both. The town of Norwalk shall have cognizance of any complaint for violation of any provision of this section.

4787 *Putting substance in water that will be carried to the land of another.*—Every person who shall willfully deposit material in any watercourse where it will naturally be carried to the land of another to his injury, shall be guilty of committing a nuisance and shall pay to the party injured thereby double damages and costs, unless he shall, within a reasonable time after notice of the injury, remove such material from said land.

4791. *Letting filthy water run on land of another.*—Every person who shall place, collect, or suffer to remain upon the surface of land owned or occupied by him, or shall discharge or suffer to be discharged from his premises upon the land of another or upon any public land, any filthy water, garbage, or other filthy or noxious matter, whereby the owner or occupant of land in the vicinity thereof shall be injured or annoyed * * * shall be guilty of committing a nuisance, and shall be fined not more than $50; the court before which such

conviction is had may order the defendant to remove such nuisance within three days, and upon his failure to do so it shall be removed by a constable of the town where such nuisance is maintained, and the court may tax the cost of the same against the defendant and issue execution therefor.

[ACTS OF 1909, CHAP. 137.]

SECTION 1. *Pollution of water from which ice is taken prohibited.*—No person shall, without having obtained permission or right, cut, damage, or pollute ice upon any river, brook, lake, pond, reservoir, or other waters from which ice is taken for domestic use or for use as an article of merchandise, after the owner of such waters, or the person, firm, or corporation having control of the same shall have posted notices as hereinafter provided, or shall throw or deposit any stick, stone, or other substance upon such ice whereby the cutting thereof is interfered with or the quality or value of such ice is affected, or shall put any filthy or impure substance into any waters from which such ice is taken: *Provided, however,* That this section shall not affect the rights of any manufacturing establishment now existing to use any waters in carrying on its business.

SEC. 2. *Notices to be posted on lands adjacent to ponds.*—Whenever any person, firm, or corporation has the right to take ice from any river, brook, lake, pond, reservoir, or other waters, and such person, firm, or corporation shall have posted printed notices in conspicuous places upon the land adjacent to such waters, substantially setting forth the provisions of the first and third sections of this act and also containing a statement that ice is to be taken from such waters for domestic use or for use as an article of merchandise, no person shall trespass upon the premises or ice which has been posted in accordance with the provisions of this section without having obtained permission from the owner or the person, firm, or corporation having control of such ice. Whenever the ownership or right to take all the ice on any body of water is not in one person, firm, or corporation, said notices shall describe the limits of ownership of such ice and posts shall be placed thereon to indicate the boundaries of such posted area.

SEC. 3. *Ice brought from another State to be examined by State board of health.*—Whenever ice shall be brought into this State to be sold for domestic use or for use as an article of merchandise, the person, firm, or corporation receiving and offering the same for sale shall notify the secretary of the State board of health of such shipment into the State and of the place where such ice was harvested, and said board of health, or any officer thereof, may take samples of such ice for examination and analysis and, if such ice shall be found unfit for domestic use, said board of health shall give the person, firm, or corporation receiving the same written notice of its findings, and such ice shall not be sold or distributed for domestic use.

SEC. 4. *Penalty.*—Violations of the foregoing provisions of this act shall be punishable by a fine of not more than $100, or imprisonment of not more than 30 days, or by both such fine and imprisonment.

(Sec. 5 amends 2599 and the Revised Statutes. See above.)

SEC. 6. *Compensation for abatement of nuisance.*—Whenever any order is made by the superior court for the abatement of any nuisance to such water or ice, and said court shall find that compliance with said order will damage any person or corporation or deprive him or it of any substantial right, said court may assess just damages in favor of such person or corporation, to be paid by such municipality, person, or corporation as the court may decree.

[ACTS OF 1913, CHAP. 220.]

SECTION 1. *Oversight of waters.*—The State board of health shall have general oversight of all inland and tidal waters, including streams, lakes, and ponds used as sources of water supply, and all springs, streams, and watercourses tributary thereto.

[PUBLIC ACTS OF 1915, CHAP. 184, AS AMENDED BY PUBLIC ACTS OF 1917, CHAP. 280.]

SECTION 1. *License required for persons engaged in business of bottling drinking water.*—Any person engaged in business of bottling drinking water shall apply to the State board of health for a license, stating the location of the spring or other source from which water is to be taken and sold and the location of the premises where such business is to be conducted. Said board shall cause an examination of the water to be made, and if it finds the same free from contamination and the premises where such bottling is to be done in a sanitary condition, with the proper facilities for cleansing and sterilizing all bottles used, it may grant a license for one year to the person making such application, upon payment of a license fee of $10. Such license may be renewed annually upon payment of a fee of $5. Said board may revoke such license at any time, upon examination, when the water sold by such license is shown to be polluted or the premises where such water is bottled to be unsanitary.

SEC. 2. *Licensing of manufacturers of soda water, ginger ale, etc.*—Any person engaged in the business of manufacturing and selling bottled soda water, ginger ale or other beverages which are composed in part of raw or unboiled water shall, if such raw or unboiled water is not obtained from a public water supply which is under the supervision of the State board of health, comply with the provisions of section 1 of this act.

[ACTS OF 1915, CHAP. 284.]

SECTION 1. *Definitions.*—The term "waters of the State" shall include that portion of the Atlantic Ocean and its estuaries and Long Island Sound and its estuaries within the State, and all springs, ponds, streams, lakes, rivers, wells, and bodies of surface or underground water, whether natural or artificial, within the boundaries of this State or subject to its jurisdiction. "Sewage" shall mean human and animal excretions and all domestic and such manufacturing wastes as may tend to the detriment of the public health.

SEC. 2 (as amended by Public Acts, 1917, chap. 220). *Investigation of sewerage construction, etc., by State board of health.*—The State board of health may investigate all points of sewage discharge and may examine all existing or proposed public sewerage systems and refuse disposal plants, and may compel their operation in a manner which shall protect the public health, or may order their alteration, extension, and replacement by other structures when necessary for the protection of the public health. After the passage of this act no public sewerage system or refuse disposal plant shall be built until the design of the same has been filed with the State board of health and approved by said board.

SEC. 3 (as amended by Public Acts, 1917, chap. 220). *Prohibiting pollution of streams—exceptions.*—No person, corporation, or municipality shall place or permit to be placed or discharge or permit to flow into any of the waters of the State any sewage, except as hereinafter provided. The provisions of this act shall not prevent the discharge of sewage from any private sewerage system or any public sewerage system owned and operated by a municipality,

provided such sewerage system was in operation and was discharging sewage into the waters of the State, or was in process of construction, on the date of the passage of this act, or to any sewerage system for which the plans shall have been submitted to and approved by the State board of health; nor shall the provisions of this act prevent the discharge into the waters of the State of sewage from any existing plant or sewerage system owned and maintained by any person or private corporation; but these exceptions shall not permit the continuance or increase of any pollution of the waters of the State which is prejudicial to the public health.

SEC. 4. *Investigation of complaints.*—Whenever complaint in writing shall be made to the State board of health by the mayor of a city, or any of the selectmen of a town, or the warden or any of the burgesses of a borough or any committeeman of a fire district, or the local health officer of a city or town, of an existing or threatened pollution of any of the waters of the State, the State board of health shall investigate such complaint, and whenever said board shall have reason to believe that any of the waters of the State are being polluted in a manner prejudicial to the public health, it may, upon its own motion, investigate such pollution. If said board shall find that any of the waters of the State are being polluted in a manner prejudicial to the public health, it may petition the superior court for such order as may be necessary to prevent the continuance of such pollution.

SEC. 5. *Penalty.*—Any person, or the directors of any private corporation, or the trustees of any institution, who shall discharge sewage, or permit the same to flow into the waters of the State contrary to the provisions of this act, shall be fined not more than $500 for each offense, or imprisoned not more than six months, or both.

SEC. 6. *Appeal from order of State board of health.*—Any person, corporation, or municipality aggrieved by any order of said board may appeal to the superior court for the county wherein the pollution occurs, or wherein the sewerage system or refuse disposal plant is located. Such appeal shall be by a petition in writing and shall be taken within 30 days from the date on which the order appealed from is mailed or served. A copy of such petition shall be served on the secretary of the State board of health at least 12 days before the return day. Said court may hear such appeal and determine all questions thereon, either by itself or a committee, in the same manner as upon complaints for equitable relief, and make such order as may be equitable. Such appeal shall be a supersedeas of the order appealed from until final action of the court thereon.

SEC. 7. *Procedure when orders are not carried out.*—If any person, corporation, or municipality shall fail to comply with any order issued under the provisions of this act, the State board of health shall bring a complaint against such person, corporation, or municipality to the superior court for Hartford County; and said court may enforce such order in any appropriate manner.

SEC. 8. *No vested right to discharge sewage.*—Nothing contained in this act shall be construed as recognizing a vested right in any person, corporation, or municipality to discharge sewage into the waters of the State, or as legalizing such disposal of sewage.

SEC. 9. *Information to be supplied by State board of health.*—The State board of health, on request of any person, corporation, or municipality, shall furnish such person, corporation, or municipality such information and assistance as may be reasonably necessary in ascertaining or installing the most practicable sewerage system or refuse disposal plant.

[ACTS OF 1915, CHAP. 306.]

SECTION 1. *State board of health to have supervision.*—The State board of health shall have supervision over all matters concerning the purity of any source of water or ice supply used by any municipality, public institution, or water or ice company for obtaining water or ice. The term "source of water or ice supply" shall include all springs, streams, watercourses, brooks, rivers, lakes, ponds, wells, or underground waters from which water or ice is taken, and all springs, streams, watercourses, brooks, rivers, lakes, ponds, wells, or underground waters tributary thereto, and all lands drained by such springs, streams, watercourses, brooks, rivers, lakes, ponds, wells, or underground waters.

SEC. 2. *Persons supplying water to submit information.*—Every person, firm, or corporation supplying water to the public at the time of the passage of this act shall, on request, furnish the State board of health with all reasonable information regarding its waterworks and the source from which its supply of water is derived. No system of water supply owned or used by such municipal or private corporation or individual shall hereafter be constructed until the plans therefor have been submitted to and approved by said board.

SEC. 3. *State board of health to investigate sources.*—The State board of health may, and, upon complaint, shall, investigate any source of water or ice supply from which water or ice used by the public is obtained, and if it finds that such source of water or ice supply is contaminated or rendered impure, it shall notify any person or corporation causing such contamination of its findings, and after hearing, shall make such orders as may be necessary to prevent the contamination thereof.

SEC. 4. *State board of health may employ agents, engineers, etc.*—The State board of health may employ agents, engineers, and assistants to carry out the provisions of this act at an expense not exceeding such sums as may be approved by the State board of control.

SEC. 5. *Appeal from orders of State board of health.*—Any person or corporation aggrieved by any order of the State board of health, made under the provisions of this act, may appeal within 30 days to the superior court for the county in which the source of the water or ice supply is located. If such source is located in more than one county the appeal shall be taken to the superior court for that county containing the part of such source nearest the mouth of the stream or river forming the main portion of the source of supply. Such appeal shall be by a petition in writing. An attested copy of such petition shall be served on the State board of health at least 12 days before the return day of such petition, and the appellant shall give notice to all parties in interest by publication in a newspaper or as may be ordered by the court to which such appeal may be brought or by any judge of such court when such court is not in session. Such court may hear such appeal by itself or a committee, and shall proceed thereon in the same manner as upon complaints for equitable relief, and may make such order, including taxation of costs, as it may find proper.

SEC. 6. *Procedure in case of violation.*—Any order of the State board of health issued under the provisions of this act to any person or corporation shall specify the time within which such person or corporation shall comply with the terms thereof. If such person or corporation shall fail to comply with the terms of such order and no appeal shall be taken therefrom, the county health officer of such county shall bring a complaint against such person or corporation to the superior court of such county.

SEC. 7. *Penalty.*—Any person or corporation violating any provision of this act, or any order of the State board of health made under the provisions hereof, shall be fined not more than $100.

[PUBLIC ACTS OF 1917, CHAP. 361.]

SECTION 1. *Investigation of pollution of waters by State board of health.*—The State board of health, acting with the persons to be appointed under the provisions of this act, is authorized to make such investigations and employ such expert assistance as may be necessary to enable it to carry out the provisions of section 9 of chapter 284 of the public acts of 1915 [see above] concerning pollution of the waters of this State.

SEC. 2. *Commission to act with State board of health.*—To assist the State board of health in carrying out the provisions of section 1 of this act, the governor shall, within 60 days after the passage of this act, appoint five persons to act with the State board of health in such investigations. At least two of such persons shall be men recognized as experienced in sanitation, and at least two of such persons shall be manufacturers. The persons appointed under the provisions of this act shall serve without compensation.

DELAWARE.

[REVISED CODE, 1915.]

738. *Rules and regulations of the State board of health.*—* * * The said board of health of the State of Delaware may make special or standing orders or regulations for the prevention of the spread of contagious or infectious diseases and for governing the receipt and conveyance of the remains of deceased persons, and such other sanitary matters as admit of and may best be controlled by a universal rule. * * *

764. *Nuisance defined.*—No person or persons shall cast, put, place, discharge in, or permit or suffer to be cast, put, placed, discharged in, or to escape into any running stream of water within the limits of this State, from which stream the inhabitants of any borough, town, or city, within the State are supplied wholly or in part with water for and as drink or beverage, any dye-stuffs, drugs, chemicals, or other substance or matter of any kind whatsoever, whereby and by means whereof the said water so supplied as and for a drink or beverage as aforesaid shall be made and become noxious to the health, or disagreeable to the senses of smell or taste.

765. *Penalty.*—Every person offending against the provisions of the preceding section shall be deemed guilty of committing a common nuisance, and upon conviction thereof by indictment in the Court of General Sessions shall be fined from $1,000 to $5,000, at the discretion of the court; and, in addition to the fine aforesaid, the court shall issue an order for the abatement of the nuisance within 20 days after the verdict of the jury upon the indictment aforesaid; and the sheriff of either of the counties of this State in which said conviction shall take place shall, under the order aforesaid, unless the said nuisance shall before the expiration of the time allowed for the abatement of the said nuisance have been abated, have full power to abate the same, and to this end shall enter on the premises from which the said nuisance proceeded and arrest, stop, and put an end to the business from the carrying on of which or in the process of which the said nuisance was created and carried on.

766. *Offal, etc., declared to be nuisance.*—No person shall put or place, or permit to be put, placed, or used, any privy, hogpen, or slaughterhouse over or so near that the excrement or offal therefrom shall escape or run into any stream of running water within the limits of this State from which the inhabitants of any town, borough, or city, within the limits aforesaid, are wholly or in part furnished with water as a drink or beverage; and anyone offending against the provisions of this section shall be deemed to be guilty of commit-

ting a common nuisance, and upon conviction thereof in the Court of General Sessions aforesaid shall be fined the sum of $100, and the court shall order the nuisance to be abated immediately.

2513[1] (as amended by acts of 1915, chap. 203). *Use of drugs to kill fish or flow of certain deleterious substances into waters a misdemeanor.*—It shall be unlawful for any person willfully to put or place in the waters aforesaid [waters of Delaware River and Bay lying between the States of Delaware and New Jersey] * * * any drug * * * for the purpose of catching and taking, killing, or injuring the fish, or to allow any dyestuff, coal or gas tar, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime refuse from gas houses, oil tanks or vessels, or any other deleterious, destructive, or poisonous substance to be turned into or allow to run into any of the waters aforesaid, in quantities sufficient to destroy or impair fish life or disturb the habits of fish inhabiting the same. Any person violating any of the provisions of this section shall be guilty of a misdemeanor, and, upon conviction thereof, shall forfeit and pay a fine of not more than $5,000, or shall be imprisoned not more than one year, or both, in the discretion of the court. * * *

2567. *Use of deleterious substances to destroy fish, misdemeanors.*—It shall not be lawful for any person or persons to place in any of the ponds, lakes, rivers, or streams of this State, or in any of the waters belonging to the State, exclusive of the Delaware River and Bay, any lime, gas tar, cocculus indicus (otherwise known as fish berries), or any other deleterious substance, * * * and any person or persons offending against the provisions of this section shall be guilty of a misdemeanor, and upon conviction shall be punished by imprisonment for a period not exceeding six months or by a fine not exceeding $50, or by both such fine and imprisonment, at the discretion of the court before which such conviction shall be had. Of all penalties recovered under this section one-half shall go to the informer and the other half shall be paid to the board of game and fish commissioners.

3806. *Befouling of streams used for drinking-water supply.*—The Court of General Sessions shall have jurisdiction to abate nuisances as follows: The befouling of streams from which the inhabitants of any borough, town, or city are supplied wholly or in part with drinking water, as provided by * * * (secs. 765 and 766, above). * * *

DISTRICT OF COLUMBIA.

[REVISED CODE, 1911.]

803. *Poisoning of springs.*—Every person convicted of * * * willfully poisoning any well, spring or cistern of water shall be sentenced to imprisonment for not more than 15 years.

900. *Use of drugs, poisons, and so forth.*—It shall be unlawful for any person to catch or kill in the waters of the Potomac River or its tributaries within the District of Columbia any fish by means of * * * drugs or poisons.

901. *Deposits of deleterious matter.*—No person shall allow any tar, oil, ammoniacal liquor, or other waste products of any gas works or works engaged in using such products, or any waste product whatever of any mechanical, chemical, manufacturing, or refining establishment to flow into or be deposited in Rock Creek or the Potomac River or any of its tributaries within the District of Columbia or into any pipe or conduit leading to the same.

[1] The number of the section in the Revised Code of 1915 which related to the subject considered in this section was 2511.

902. *Penalties.*—Any person who shall violate any of the provisions of the six next preceding sections shall be fined for each and every such offense not less than $10 nor more than $100, and in default of payment of fine shall be imprisoned for a period not exceeding six months; and any officer or other person securing such conviction shall be entitled to and receive one-half of any fine or fines imposed upon and paid by the party or parties adjudged guilty.

[27 STATUTES, P. 394.]

SEC. 2. *Rules and regulations.*—The Commissioners of the District of Columbia are hereby authorized and empowered to make and enforce all such reasonable and usual police regulations * * * as they may deem necessary for the protection of lives, limbs, health, comfort, and quiet of all persons, and the protection of all property within the District of Columbia.

[SIXTY-FOURTH CONGRESS, SESS. I, CHAP. 433.]

SEC. 9. *Drainage of sewage from Maryland through sewerage system of District.*—For the protection of streams flowing through United States Government parks and reservations in the District of Columbia from pollution by sewage discharged therein from sewerage systems of Maryland towns and villages bordering said District, the commissioners are authorized to enter into an agreement with the proper authorities of the State of Maryland for the drainage of such sewerage systems into and through the sewerage system of the District of Columbia; and the said commissioners are further authorized to permit connections of Maryland sewers with the District of Columbia sewerage system at or near the District line whenever, in their judgment, the sanitary conditions of streams flowing into and through such United States Government parks and reservations in the District of Columbia are such as to demand the elimination of such pollution: *Provided*, That all cost of construction of such sewers to and connection with the sewerage system of the District of Columbia shall be paid by the proper authorities of the State of Maryland, and that said State shall enter into such agreement with the commissioners and shall guarantee the protection of the District of Columbia sewerage system from unauthorized connections thereto, and shall reimburse the District of Columbia for the actual cost of pumping and handling such sewerage [sic] by annual payments for such service as determined by the commissioners in such agreement; all such sums collected therefor to be paid into the Treasury of the United States through the collector of taxes to the credit of the District of Columbia.

FLORIDA.

[COMPILED LAWS, 1914.]

1120a. *State board of health to regulate disposition of sewage in municipalities, etc.*—The State board of health shall have the power to make, adopt, promulgate, and enforce rules and regulations from time to time * * * to regulate the method of disposition of garbage or sewage and any other refuse matter in or near any incorporated city or town or unincorporated town or village of this State * * *.

1122. *Regulations of State board of health.*—It shall be the duty of the State board of health to formulate such rules and regulations for the preservation of the public health as in their judgment they may deem necessary, and to meet upon the first Monday of May of each year to formulate such additional rules and regulations for the preservation of public health as their experience may suggest * * *.

1155a. *Definition.*—That the term "underground waters of the State," when used in this act [secs. 1155a–1155e and 3603b], shall include all underground streams and springs and underground waters within the borders of the State of Florida, whether flowing in underground channels or passing through the pores of the rocks.

1155b. *Prohibiting discharge of sewage into underground waters except with permit.*—No municipal corporation, private corporation, person, or persons within the State shall, after the passing of this act, use any cavity, sink, driven or drilled well now in existence, or sink any new well within the corporate limits, or within 5 miles of the corporate limits, of any incorporated city or town, or within any unincorporated city, town, or village, or within 5 miles thereof, for the purpose of draining any surface water or discharging any sewerage [sic] into the underground waters of the State without first obtaining a written permit from the State board of health.

1155c. *Provisions for issuing permits.*—Every such permit for the discharge of sewerage [sic] or surface water shall be revocable or subject to modification or change by the State board of health on due notice after an investigation and hearing and an opportunity for all interests and persons interested therein to be heard thereon, said notice or notices being served on the person or persons owning, maintaining, or using the well, cavity, or sink, and by publication for two weeks in a newspaper published in the county in which said well, cavity, or sink is located. The length of time after the receipt of the notice within which it shall be discontinued may be stated in the permit. All such permits, before becoming operative, shall be filed in the office of the clerk of the circuit court for the county in which such permit has been granted.

1155d. *Definition.*—For the purpose of this act sewerage [sic] shall be defined as any substance that contains any of the waste products or excrementitious or other discharges from the bodies of human beings or animals.

1155e. *Discharge of sewage into underground waters to be discontinued on order of board of health.*—Every individual, municipal corporation, private corporation, or company shall discontinue the discharge within the corporate limits, or within 5 miles of the corporate limits of any incorporated city or town, or within any unincorporated city, town, or village, or within 5 miles thereof, of sewerage [sic] or surface drainage into any of the underground waters of the State within 10 days after having been so ordered by the State board of health.

1280o. *Persons engaged in mining must provide places for waste.*—Any person, firm, or corporation engaged in the business of mining any mineral or subterranean product in this State shall provide necessary places of deposit for the waste and débris of any mine or mines operated by such person, firm, or corporation.

1280p. *Escape of waste prohibited—Slightly discolored water an exception.*—Such person, firm, or corporation shall use due diligence to prevent the escape of all waste and débris from any mine or mines operated by such person, firm, or corporation into the streams and rivers of this State, but the escape of water only slightly discolored shall not be construed as the escape of waste and débris, nor shall the washing away of waste or débris due to excessive rains or floods, which are beyond the control of persons, firms, or corporations operating such mine or mines by the exercise of due diligence, be within the meaning of this act.

1280q. *Action on affidavits alleging negligent escape of waste.*—Upon the presentation to the board of county commissioners of any county in this State of an affidavit, signed by at least 10 citizens owning property in such county, which affidavit shall allege that some person or persons, firm or firms, cor-

poration or corporations conducting mining operations in this State, giving the name or names thereof, are not using due diligence to prevent the escape of waste or débris from any mine or mines operated by such person or persons, firm or firms, corporation or corporations into any stream or river of this State, and that such waste or débris is escaping into a stream or river in the county in which the affiants reside, but no prosecution for perjury shall be had on such affidavit, then it shall be the duty of the board of county commissioners to immediately institute suit in the name of such county to enjoin such person or persons, firm or firms, corporation or corporations from allowing such waste or débris to escape, and the joinder of any number of persons, firms, or corporations as defendants shall be no grounds of objections to the suit, and may join parties defendants not named in the affidavit if necessary.

1280r. *Where suit shall be commenced.*—Such cause of action shall be considered to arise in the county wherein the affidavit shall be presented to the board of county commissioners, and suit shall be commenced therein regardless of where the mine or mines from which the waste or débris is escaping are located.

1280s. *Procedure where regular attorney of county commissioners represents any mine operator.*—In the event the regular attorney of the board of county commissioners represents any person, firm, or corporation engaged in mining in this State, it shall be the duty of the State attorney of the circuit in which the county bringing the suit is situated to conduct the suit, and if the injunction shall be granted the county shall recover from the defendant or defendants such reasonable attorney's fee as shall be allowed by the court, which shall be paid to the attorney conducting the suit, in addition to the compensation regularly paid him.

3176a. *Punishment for misdemeanors where not otherwise provided.*—The punishment for commission of crimes other than felonies in this State, when not otherwise provided by statute, or when the penalty provided by such statute is ineffectual because of constitutional provisions, or because the same is otherwise illegal or void, shall be a fine not exceeding $200 or imprisonment not exceeding 90 days, or both, at the discretion of the court.

3587. *Poisoning wells, etc.*—Whoever * * * willfully poisons any spring, well, or reservoir of water with such intent [to kill or injure another person] shall be punished by imprisonment in the State prison for life or for any term of years.

3603. *Defilement of springs, etc.*—Whoever willfully or maliciously defiles, corrupts, or makes impure any spring or other source of water or reservoir, or destroys or injures any pipe, conductor of water, or other property pertaining to an aqueduct, or aids or abets in any such trespass, shall be punished by imprisonment not exceeding one year, or by fine not exceeding $1,000.

3603a. *Prohibiting pollution public water supplies.*—Any person or persons, firm, company, corporation, or association in this State, or the managing agent of any person or persons, firm, company, corporation, or association in this State, or any duly elected, appointed, or lawfully created State officer of this State, or any duly elected, appointed, or lawfully created officer of any county, city, town, municipality, or municipal government in this State, who shall deposit, or who shall permit or allow any person or persons in their employ or under their control, management, or direction to deposit in any of the waters of the lakes, rivers, streams, and ditches in this State, any rubbish, filth, or poisonous or deleterious substance or substances liable to affect the health of persons, fish, or live stock, or place or deposit any such deleterious substance or substances in any place where the same may be washed or infiltered into any of the waters herein named, shall be deemed guilty of a misdemeanor, and upon

conviction thereof in any court of competent jurisdiction shall be fined in a sum not more than $500: *Provided further*, That the carrying into effect of the provisions of this act shall be under the supervision of the State board of health.

3603b. *Pollution of underground waters.*—Any municipal corporation, private corporation, person, or persons that shall discharge sewerage [sic] or surface drainage, or permit the same to flow into the underground waters of the State contrary to the provisions of this act [secs. 1155a–1155e] shall be deemed guilty of a misdemeanor, and shall upon conviction be punished by a fine of $25 for each offense, and the doing of the prohibited act for each day shall constitute a separate offense, or by imprisonment not exceeding one month, or both, at the discretion of the court.

3622. *Penalty for violation of regulations of board of health.*—Whoever violates, disobeys, omits, neglects, or refuses to comply with * * * any of the rules and regulations which may be duly promulgated by said State health officer or said State board of health shall be punished by imprisonment not exceeding six months, or by fine not exceeding $1,000.

3622a. *Penalty.*—Any person who shall violate, disobey, refuse, omit, or neglect to comply with any rule of said State board of health made by it in pursuance of this act [sec. 1120a] shall be guilty of a misdemeanor, and upon conviction thereof shall be punished in the manner provided by law for violation of the rules of said board.

3765a. *Use of lime or poisonous minerals to catch fish.*—On and after the passage and approval of this act [secs. 1155a–1155e] by the governor it shall be unlawful for any person or persons to use or place any lime or poisonous minerals in any of the fresh-water streams, rivers, lakes, or ponds in the State of Florida for the purpose of killing any of the fishes in said waters, and whoever by the use of any lime or poisonous minerals kills any fishes in said waters shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by a fine in a sum of not more than $100 or less than $10, or by imprisonment in the county jail not more than three months, or by both fine and imprisonment, at the discretion of the court.

GEORGIA.

[ANNOTATED CODE, 1914.[1]]

855n. *Preventing pollution of water supplies.*—The council * * * shall have power * * * to erect or authorize or prohibit the erection of * * * waterworks in the town; to prevent injury to or pollution of the same, or to the water or healthfulness of the town * * *.

1662. *Investigation of water supplies.*— * * * If [the State board of health] shall respond promptly when called upon by the State or local government and the municipal and township boards of health to investigate and report upon the water supply, sewerage, disposal of excreta * * * of any place or public buildings. * * *

3629. *Owner of running water.*—Running water, while on land, belongs to the owner of it, but he has no power to divert it from the usual channel, nor can he so use or adulterate it as to interfere with the enjoyment of it by the next owner.

3630. *Streams boundary lines.*—The beds of streams not navigable belong to the owner of the adjacent land; if the stream of water is the dividing line, each owner is entitled to the thread or center of the main current; if the current change gradually, the line follows the current; if from any cause it takes

[1] Exclusive of Penal Code, for which see p. 190.

a new channel, the original line, if capable of identification, remains the boundary. Gradual accretions of land on either side accrue to the owner.

3631. *Navigable streams.*—A navigable stream is one capable of bearing upon its bosom, either for the whole or a part of the year, boats loaded with freight in regular course of trade. The mere rafting of timber or transporting wood in small boats does not make a stream navigable.

3632. *Owner of adjacent lands.*—The rights of the owner of lands adjacent to navigable streams extend to low-water mark in the bed of the stream.

3633. *Power of owner of streams.*—The owner of a stream not navigable is entitled to the same exclusive possession thereof as he has of any other part of his land; and the legislature has no power to compel or interfere with him in its lawful use, for the benefit of those above or below him on the stream, except to restrain nuisances.

3635. *Boundaries of lands on tidewaters.*—The title to the beds of all tidewaters in this State, where the tide regularly ebbs and flows, and which are not navigable under the next succeeding section, shall vest in the present owner of the adjacent land for all purposes, including, among others, the exclusive right to oysters, clams, and other shellfish therein or thereon. If the water is the dividing line, each owner's boundary shall extend to the main thread or channel of the water. If the main thread, or center, or channel of the water changes gradually, the line follows the same, according to the change. If for any cause it takes a new channel, the original line, if capable of identification, remains the boundary. Gradual accretions of land on either side accrue to the owner.

3636. *Navigable tidewater defined.*—A navigable tidewater is any tidewater, the sea or any inlet thereof, or other bed of water where the tide regularly ebbs and flows, which is in fact used for the purposes of navigation or is capable of bearing upon its bosom at mean low tide boats loaded with freight in the regular course of trade. The mere rafting of timber thereon or the passage of small boats thereover, whether for the transportation of persons or freight, shall not be deemed navigation within the meaning of this and the preceding section and does not make tidewater navigable.

4475. *Watercourses—Rights of owner.*—The owner of land is entitled to the free and exclusive enjoyment of all watercourses, not navigable, flowing over his land and * * * the adulterating thereof so as to interfere with its [the stream's] value to him is a trespass upon his property.

4476. *Underground streams.*—The course of a stream of water underground, and its exact condition before its first use, are so difficult of ascertainment that trespass can not be brought for any supposed interference with the rights of a proprietor.

[PENAL CODE, 1914.]

230a. *Prohibiting floating of sawdust into streams.*—It shall be unlawful to float sawdust into any of the streams of this State.

230b. *Penalty.*—Any person or persons or corporations violating the provisions of section 230a shall be punished as for a misdemeanor.

230c. *Act must have approval of grand juries.*—This article [secs. 230a–230c] shall not go into effect in any county until it has been recommended by two grand juries of the county.

484. *Carcasses of animals not to be placed in streams.*—If any person shall place the carcass of a horse, cow, sheep, goat, dog, or other animal in any stream * * * he shall be guilty of a misdemeanor.

611. *Poisoning fish.*—Any person who shall directly by himself or by aiding or abetting others put walnut hulls, walnut leaves, devil shoestring, or any poisonous substances whatever of any kind in any waters, either running streams or standing waters, such as lakes, ponds, or eddy places in any river or creek within the limits of this State, which will be likely to drive away or poison the fish therein by contaminating said waters, shall be guilty of a misdemeanor.

774. *Prohibiting poisoning of water to poison fish.*—Any person who shall poison any lake, river, stream, or pond, with a view of poisoning fish therein, shall be guilty of a misdemeanor.

775. *Penalty for poisoning water supplies.*—If any person shall willfully and wantonly poison or procure another to poison any spring, fountain, well, or reservoir of water, he shall be guilty of a felony, and on conviction therefor shall be imprisoned in the penitentiary for a term of not less than 2 nor more than 20 years.

HAWAII.

[REVISED LAWS, 1915.]

918. *Regulations of board of health.*—The board of health, with the approval of the governor, may make such regulations respecting nuisances, foul or noxious odors, gases or vapors, water in which mosquito larvæ breed, sources of filth, causes of sickness or disease, within the respective districts of the Territory, and on board of any vessel; as also respecting adulteration and false branding of food; location, air space, ventilation, sanitation, drainage, and sewage disposal of buildings, courts, areas, and alleys; privy vaults and cesspools; fish and fishing; interments and dead bodies; cemeteries and burying grounds; laundries, stables, bakeries, poi shops, abattoirs, fish, meat or vegetable stores or markets, hotels, lodging houses, tenements, or any place or building where noisome or noxious trades or manufactures are carried on, or intended to be carried on; milk; poisonous drugs; pig and duck ranches, as it shall deem necessary for the public health and safety.

975. *Committing nuisance in stream.*—Every person who shall * * * commit any nuisance in any stream * * * shall, on conviction, pay a fine not exceeding $3 or be imprisoned at hard labor for any term not exceeding 30 days.

4138. *Certificate required before water is furnished for potable purposes.*—No water shall be furnished for potable purposes in the Territory by any person, firm, corporation, or organization of any kind, county, municipal, or territorial department, whether for pay or without pay, except after a certificate first obtained of the territorial board of health setting forth that said board has examined the potability of the water intended to be furnished, the source of its supply, the system of its distribution, and that the water, source, and system of distribution are reasonably free from contamination and pollution, and that the water at the time is, in the opinion of the board, suitable for potable purposes without danger to public health.

4139. *Corporations, etc., must discontinue furnishing water on order of board of health.*—No person, firm, corporation, or organization of any kind, county, municipal, or territorial department shall continue to furnish water for potable purposes after written notice from the territorial board of health that the water, the source of supply, or system of distribution is not free from contamination or pollution, and that the water is, in the opinion of the board, unsuitable for potable purposes and dangerous to public health.

4140. *Penalty.*—Any person, firm, corporation, or organization of any kind who shall furnish or continue to furnish water for potable purposes contrary

to the provisions of this chapter shall, upon conviction, be punished by a fine of not more than $100.

[PRIVY VAULTS AND CESSPOOLS. REG. BD. OF H., FEB. 11, 1915.]

SEC. 13. No privy vault, sink, or cesspool shall hereafter be located or constructed within 50 feet of any stream, lake, pond, well, or spring of water, nor within 2 feet of the line of any lot, nor placed in such a position that it is not easily accessible for emptying and cleaning. No privy vault shall extend farther beneath the privy covering it than to meet a perpendicular line drawn from the front edge of the seats in said privy. All privies shall be made fly proof.

The word "cesspool" in this code shall be construed to mean and include all excavations for the reception of waste matter into which waste water flows. All cesspools shall be properly sealed.

The words "privy vault" in this code shall be construed to mean and include all excavations for the reception of waste matter into which no waste water flows.

SEC. 14. When deemed necessary by the board of health or its agents, the sides and bottom of any privy vault, sink, or cesspool shall be made either wholly or in part water-tight, so as to prevent any saturation of the ground about the said vault, sink, or cesspool, and shall be properly vented.

SEC. 15. A cesspool or other sanitary means of disposing of waste shall be completed before any building hereafter to be constructed shall be occupied. No structure or cover shall be put upon or over any privy vault, sink, or cesspool until it has been inspected by the proper agent of the board of health and approved as meeting the requirements of these regulations and of public health. * * *.

[POLLUTION OF SHELLFISH. REG. BD. OF H., FEB. 11, 1915.]

SEC. 124. Where any river, stream, lake, pond, or other body of fresh or salt water is polluted by sewage or other deleterious matters the taking of fish, shellfish, or any other product of the water for the purpose of using or disposing of same for human consumption is hereby prohibited * * *.

IDAHO.

[REVISED CODES, 1908.]

1086. *Regulations of State board of health.*—Whenever the State board of health shall have cause to believe that there is any danger of cholera, smallpox, or other contagious or infectious disease invading this State or country it shall be the duty of said board to * * * adopt and enforce such rules and regulations as may be necessary to prevent the introduction of such infectious or contagious disease within this State, and any person or persons or corporations refusing or neglecting to obey such rules and regulations shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not less than $50 nor more than $300, or imprisoned in the county jail for not less than 30 nor more than 90 days, or be punished by both such fine and imprisonment, in the discretion of the court, for every such offense.

6313. *Punishment for misdemeanor.*—Except in cases where a different punishment is prescribed by this code, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding six months, or by a fine not exceeding $300, or by both.

6861. *Prohibiting poisoning water supplies.*— * * * every person who willfully poisons any spring, well, or reservoir of water is punishable by imprisonment in the State prison for a term not less than 1 nor more than 10 years.

7137. *Prohibiting pollution of water supplies.*—Every person * * * who shall empty or place or cause to be emptied or placed into any such canal, ditch, flume, or reservoir any rubbish, filth, or obstruction to the free flow of the water is guilty of a misdemeanor.

[SESSION LAWS OF 1909, P. 90.]

SEC. 6. *Trade wastes not to be emptied into watercourses.*—It shall be unlawful for the owner or owners of any sawmill, reduction works, smelters, refining or concentration works, or any of the employees thereof, or any other person or persons whomsoever, to deposit, throw, or in any way permit to pass into any stream or lake any sawdust, chemicals, or other substances that will or may tend to the destruction or driving away from such waters any fish or kill any fish by the use of poison or deleterious drugs: * * * *Provided further*, That nothing in this act contained shall prevent the owners of any quartz mill or reduction works in this State, now or hereafter to be located upon any natural stream or lake from operating said quartz mill or reduction works where the said owner or owners thereof shall build or cause to be built a suitable dam for settling purposes to be used in connection with said quartz mill or reduction works, for preventing any deleterious chemicals from flowing into such stream or lake.

SEC. 16. *Confiscation of poisons, etc.*— * * * All * * * lime, poisons, drugs, and other means and devices for unlawful taking or killing of any kind found in the possession of any person who may be detected in unlawfully taking fish from any of the waters of the State shall be seized by the officer making the arrest, and if it appears from the evidence before the magistrate trying the case that the * * * lime, poisons, drugs, and other means and devices for taking or killing fish are used or were about to be used or intended to be used for the unlawful taking of fish, the same are hereby confiscated and shall be ordered sold by the magistrate at public or private sale and the proceeds must be turned over to the fish and game warden to be applied to the fish and game fund. * * *

SEC. 17. *Penalty.*— * * * any person or persons, company or corporation, agent or employee violating any of the provisions of this act with respect to the use of * * * drugs or other means for the taking or destroying of any fish or game unlawfully shall be guilty of a misdemeanor and upon a conviction shall be fined in a sum not less than $150 nor more than $300 for each offense, or imprisonment in the county jail for a period of not less than 30 days nor more than 6 months, or by both such fine and imprisonment.

[SESSION LAWS OF 1913, CHAP. 173.]

SEC. 1. *Provisions for preventing pollution of ice.*—Ice offered or intended for public use or consumption shall be kept stored in clean places free from all filth, offal, refuse, and polluted waters and separate and removed from contact with animal or vegetable matter, and not in proximity to any cesspool, privy, vault, or sewer, nor in places where such ice may be subject to the contamination from, or the action of, acids, oils, noxious, offensive, or injurious gases, smoke, or vapors; and all ice kept or stored in violation of this section shall be deemed polluted ice and not fit for human consumption; and it shall be unlawful to sell, offer for sale, or store for sale such polluted ice.

SEC. 2. *Water to be supplied for domestic purposes must be kept unpolluted.*—That any corporation or person owning or maintaining any plant or system for the supply to the inhabitants of this State, or any part thereof, of water for domestic purposes shall keep the same clean and free from all impurities, accumulation of sediment, offal, refuse, dead animals, and all other foreign substances which tend to injure the health of the consumers of such water. Any person or corporation failing or neglecting to comply with any of the provisions of this act shall be guilty of a misdemeanor.

[DISPOSAL OF DEAD ANIMALS. REG. BD. OF H., MAY 13, 1914.]

RULE XXXI. No carcass of any dead animal shall be left unburied in the State of Idaho, nor shall it be thrown into any stream, lake, pond, well, or other body of water therein. Any such carcass shall be buried by the owner so that it will be covered by at least 3 feet of earth. Burial shall be made within 24 hours after death (and in all cases of death from a communicable disease the body shall be thoroughly enveloped in quicklime). At all municipal dumping grounds where carcasses are disposed of, provision must be made for their immediate burial. In lieu of the foregoing, the dead bodies of animals may be burned.

ILLINOIS.

[CRIMINAL CODE.]

188a (added by Laws of 1917, p. 351). *Penalty for damaging water supplies of troops.*—Any person who shall interfere with, damage, or injure any source of supply for water * * * for troops in the employment of the State or of the United States shall be punished by a fine of not less than $100 nor more than $5,000 and imprisonment in the penitentiary not less than one year nor more than 20 years.

[REVISED STATUTES, 1915–1916, CHAP. 19.]

47. *Appointment of Rivers and Lakes Commission.*—The governor of the State of Illinois, by and with the advice and consent of the Senate, shall appoint a rivers and lakes commission in and for the State of Illinois, whose powers and duties shall be as specified herein; and the governor shall, at the time of the appointment of said commission, as herein provided, designate one member thereof, who shall be the chairman of said commission, and shall thereafter name the successor of the said chairman as the vacancy occurs.

48. *Membership of commission.*—The members of said rivers and lakes commission shall consist of three members, not more than two of whom shall be of the same political party. This commission shall consist of one civil engineer of recognized standing in his profession, one lawyer of active practice and of large experience in his profession, and one person who shall be neither a lawyer nor a civil engineer, who is intimately acquainted with the rivers and lakes of Illinois.

49. *Terms of office.*—One of said members shall be appointed for a term of one year, one for a term of two years, and one for a term of three years, and as the terms of the respective members expire their successors shall be appointed for periods of three years each, and shall serve for such time, unless sooner removed by the governor of this State for good cause, which may satisfy him that it is not desirable that said member shall no [sic] longer continue to serve upon said commission.

51. *Jurisdiction.*—Said rivers and lakes commission shall, upon behalf of the State of Illinois, have jurisdiction and supervision over all of the rivers and

lakes of the State of Illinois wherein the State of Illinois or the people of the State of Illinois have any rights or interests. * * *

53. *Encroachments.*—It shall be the duty of said commission to have a general supervision of every body of water within the State of Illinois wherein the State or the people of the State have any rights or interests, whether the same be lakes or rivers, and at all times to exercise a vigilant care to see that none of said bodies of water are encroached upon or wrongfully seized or used by any private interest in any way except as may be provided by law, and then only after permission shall be given by said commission, and from time to time for that purpose to make accurate surveys of the shores of said lakes and rivers and to jealously guard the same in order that the true and natural conditions thereof may not be wrongfully and improperly changed to the detriment and injury of the State of Illinois.

The rivers and lakes commission of Illinois shall have power and authority to inquire into encroachments upon, wrongful invasion, and private use of every stream, river, lake, or other body of water in which the State of Illinois has any right or interests. The commission shall have power to make and enforce such orders as will secure every stream, river, lake, or other body of water, in which the State of Illinois has any right or interest against encroachment, wrongful seizure, or private use.

54. *Complaints—hearings.*—It shall be the duty of the rivers and lakes commission of Illinois to receive from any citizen complaints as to any invasion of or encroachment upon any rights of the State of Illinois, or of any citizen of the State of Illinois, with reference to any of the public bodies of water of the State of Illinois, or as to any interference with the right or claim of any citizen to use or enjoy any public water of this State, and upon being requested so to do, the said rivers and lakes commission shall hold a public hearing for the purpose of taking evidence with reference to the subject matter of said complaint, and of hearing all persons who may appear upon behalf of, or in opposition to said petition, and at the conclusion of such hearing they shall enter an order defining the rights and interests of the parties, and prescribing their duties.

59. *Investigation of encroachments—actions.*—It shall be the duty of said commission to make a careful investigation of each and every body of water, both river and lake, in the State of Illinois, and to ascertain to what extent, if at all, the same have been encroached upon by private interests or individuals, and wherever they believe that the same have been so encroached upon, to commence appropriate action either to recover full compensation for such wrongful encroachment, or to recover the use of the same, or of any lands improperly or unlawfully made in connection with any public river or lake for the use of the people of the State of Illinois. The right and authority hereby given and created shall not be held to be exclusive, or to take from the attorney general or any other law officer of the State of Illinois, the right to commence suit or action.

60. *Pollution of streams.*—It shall be the duty of said rivers and lakes commission to see that all of the streams and lakes of the State of Illinois, wherein the State of Illinois, or any of its citizens, has any rights or interests, are not polluted or defiled by the deposit or addition of any injurious substances, and that the same are not affected injuriously by the discharging therein of any foul or injurious substances, so that fish or other aquatic life is destroyed. And if, upon investigation, the commission shall find that any of such streams and lakes are so polluted and defiled, or are affected injuriously

by the discharging therein of any foul or injurious substances so that fish or other aquatic life is destroyed, it shall be the duty of said commission to enter an order commanding the abatement of such nuisances within such time as may be fixed by the commission.

61. *Office a repository of data.*—It shall be the duty of said rivers and lakes commission to obtain and preserve in its office all obtainable data with reference to the rivers and lakes of Illinois, and to make such office a repository thereof, and all of such records and data shall be public and be available for the use of any person who may be interested therein; and certified copies thereof shall be received in court as evidence of the facts therein set forth. To secure the information authorized by this section to be obtained the commission or its duly authorized agent may cross any lands within the State and enter any building or factory where the power used, is of hydraulic generation.

71. *Legal representative of commission.*—The attorney general of the State of Illinois, or any State's attorney of any county of the State of Illinois, or any attorney who may be authorized so to do by the said rivers and lakes commission, shall have the power to represent the said rivers and lakes commission, and in the name and by the authority of the State of Illinois, to invoke for the purposes specified in this act, all of the power of the State of Illinois to prevent the wrongs and injuries herein referred to, and for that purpose, such attorney general, State's attorney, or authorized attorney shall be deemed to be the proper representative of the State of Illinois, with full power and authority upon its behalf to prosecute all necessary suits or actions.

72. *Act not to impair rights of citizens as to use of public waters.*—Said rivers and lakes commission shall, for the purpose of protecting the rights and interests of the State of Illinois, or the citizens of the State of Illinois, have full and complete jurisdiction of every public body of water in the State of Illinois, subject only to the paramount authority of the Government of the United States with reference to the navigation of such stream or streams, and the laws of Illinois, but nothing in this act contained shall be construed or held to be any impairment whatsoever of the rights of the citizens of the State of Illinois to fully and in a proper manner enjoy the use of any and all of the public waters of the State of Illinois, and the creation of said commission shall be deemed to be for the purpose of protecting the rights of the people of the State in the full enjoyment of all of such bodies of water, and for the purpose of preventing unlawful and improper encroachment upon the same, or impairment of the rights of the people with reference thereto, and every proper use which the people may make of the public rivers, and streams and lakes of the State of Illinois shall be aided, assisted, encouraged, and protected by the rivers and lakes commission herein provided for.

And should said commission, or any member thereof, attempt to interfere with any valid right upon the part of the people of this State, any appropriate action shall lie against said rivers and lakes commission or any member thereof, to inquire into the legality and validity of such act.

73. *How act is to be construed.*—At all times this act shall be construed in a liberal manner for the purpose of preserving to the State of Illinois and the people of the State, fully and unimpaired, the rights which the State of Illinois and the people of the State of Illinois may have in any of the public waters of the State of Illinois, and to give them in connection therewith the fullest possible enjoyment thereof and to prevent to the fullest extent the slightest improper encroachment or invasion upon the rights of the State of Illinois or any of its citizens with reference thereto.

(REVISED STATUTES, 1915–16, CHAP. 24.)

169. *Cities and villages may prevent pollution of water supply.*—The city council or board of trustees shall have the power to provide for a supply of water by the boring and sinking of artesian wells, or by the construction and regulation of wells, pumps, cisterns, reservoirs, or water works, and to borrow money therefor, and to authorize any person or private corporation to construct and maintain the same at such rates as may be fixed by ordinance, and for a period not exceeding 30 years; also to prevent the unnecessary waste of water; to prevent the pollution of the water and injuries to such wells, pumps, cisterns, reservoirs, or water works.

170. *Jurisdiction of city or village.*—For the purpose of establishing or supplying water works, any city or village may go beyond its territorial limits and may take, hold, and acquire property by purchase or otherwise; and shall have power to take and condemn all necessary lands or property therefor in the manner provided for the taking or injuring private property for public uses; and the jurisdiction of the city or village to prevent or punish any pollution or injury to the stream or source of water or to such water works shall extend 5 miles beyond its corporate limits, or so far as such water works may extend.

243. *Ohio River towns have jurisdiction over their river frontage.*—Each of the several cities and incorporated towns of this State lying on the Ohio River and bounded thereby are hereby invested with jurisdiction over their river fronts and shall have jurisdiction over the waters of said river in all cases occurring on said river and opposite to each of said cities or incorporated towns, coextensive with the jurisdiction of the several counties in this State in which said cities or incorporated towns may lie: *Provided*, Nothing herein contained shall be construed so as to extend the jurisdiction of said cities or incorporated towns over any islands in said river included within the corporated limits of any county in the State of Kentucky.

[REVISED STATUTES, 1915–16, CHAP. 38.]

202. *Prohibiting pollution of water supplies.*—Whoever willfully and maliciously defiles, corrupts, or makes impure any spring or other source of water, or reservoir, or destroys or injures any pipe, conductor of water, or other property pertaining to an aqueduct, or aids and abets in any such trespass, shall be fined not exceeding $1,000 or confined in the county jail not exceeding one year.

221. *Defining public nuisance.*—It is a public nuisance—

(2) To throw or deposit any offal or other offensive matter or the carcass of any dead animal in any watercourse, lake, pond, spring, well, or common sewer, street, or public highway.

(3) To corrupt or render unwholesome or impure the water of any spring, river, stream, pond, or lake, to the injury or prejudice of others.

(8) To erect, continue, or use any building or other place for the exercise of any trade, employment, or manufacture which, by occasioning noxious exhalations, offensive smells, or otherwise, is offensive or dangerous to the health of individuals or of the public.

222. *Penalty.*—Whoever causes, erects, or continues any such nuisance shall for the first offense be fined not exceeding $100, and for a subsequent offense shall be fined in a like amount and confined in the county jail not exceeding three months. Every such nuisance, when a conviction therefor is had in a court of record, may, by order of the court before which the conviction is had, be abated by the sheriff or other proper officer at the expense of the defend-

ant; and it shall be no defense to any proceeding under this section that the nuisance is erected or continued by virtue or permission of any law of this State.

230. *Prohibiting poisoning water supplies.*—Whoever * * * willfully poisons any spring, well, or reservoir of water with such intent [intent to cause the death of any person] shall be imprisoned in the penitentiary not exceeding 20 years.

[REVISED STATUTES, 1915–16, CHAP. 42.]

244. *Creation of sanitary districts.*—Whenever any area of contiguous territory within the limits of a single county shall contain two or more incorporated cities, towns, or villages owning and operating, either or any of them, a system or systems of waterworks and procuring a supply of water from Lake Michigan, and shall be so situated that the construction and maintenance of a common plant for the purification and treatment of sewage and the maintenance of a common outlet for the drainage thereof will conduce to the preservation of the public health, the same may be incorporated as a sanitary district under this act * * *.

250. *Powers of board of trustees.*—The board of trustees of any sanitary district organized under this act shall have power to provide for the disposal of the sewage thereof and to save and preserve the water supplied to the inhabitants of such district from contamination and for that purpose may construct and maintain an inclosed conduit or conduits, main pipe or pipes, wholly or partially submerged, buried or otherwise, and by means of pumps or otherwise cause such sewage to flow or to be forced through such conduit or conduits, pipe or pipes, to and into any ditch or canal constructed and operated by any other sanitary district, after having first acquired the right so to do, or such board may provide for the drainage of such district by laying out, establishing, constructing, and maintaining one or more channels, drains, ditches, and outlets for carrying off and disposing of the drainage (including the sewage) of such district, together with such adjuncts and additions thereto as may be necessary or proper to cause such channels or outlets to accomplish the end for which they are designed, in a satisfactory manner, including pumps and pumping stations and the operation of the same. Such board may also treat and purify such sewage so that when the same shall flow into any lake, it will not injuriously contaminate the waters thereof, and may adopt any other feasible method to accomplish the object for which such sanitary district may be created, and may also provide means whereby the said sanitary district may reach and procure supplies of water for diluting and flushing purposes: *Provided, however*, That nothing herein contained shall be construed to empower or authorize such board of trustees to operate a system of water works for the purpose of furnishing or delivering water to any such municipality or to the inhabitants thereof. Nothing in this act contained shall authorize said trustees to flow the sewage of such district into Lake Michigan and any such plan for sewage disposal by any sanitary district organized hereunder is hereby prohibited.

263. *Prevention of pollution of sources of water supplies.*—The board of trustees of any such sanitary district shall have power and authority to prevent the pollution of any waters from which a water supply may be obtained by any city, town, or village within said district, and shall have the right and power to appoint and support a sufficient police force, the members of which may have and exercise police powers over the territory within such drainage district, and over the waters from which said water supply may be obtained, for a distance of 3 miles from the shore thereof, for the purpose of preventing the

pollution of said waters, and any interference with any of the property of such drainage district; but such police officers when acting within the limits of any such city, town, or village shall act in aid of the regular police force thereof, and shall then be subject to the direction of its chief of police, city or village marshals or other head thereof: *Provided*, That in so doing they shall not be prevented or hindered from executing the orders and authority of said board of trustees of such drainage district: *Provided further*, That before compelling a change in any method of disposal of sewage so as to prevent the said pollution of any water, the board of trustees of such district shall first provide some other method of sewage disposal.

[REVISED STATUTES, 1915–1916, CHAP. 93.]

52. *Casing off of fresh water from oil wells.*—It shall be the duty of any person, firm, or corporation sinking a well in any oil or gas bearing rock, or having sunk such well and maintaining the same, to case off and keep cased off all fresh water from such well.

52a. *Penalty.*—Any person * * * who * * * shall fail and neglect to properly case off fresh water from such well and keep the same cased off while said well is maintained, as provided in * * * [sec. 52 above], shall be liable to a penalty of $100 for each and every violation thereof, and the further sum of $100 for each 10 days during which such violation shall continue; and all such penalties shall be recoverable in a civil action brought in any court of competent jurisdiction in any county[1] in which said violation occurred, brought in the name of the State of Illinois on the relation of such county, and for the use and benefit of such county, and in all such cases; if there be recovery by the State, it shall recover in addition to such penalities a reasonable attorney's fee.

[REVISED STATUTES, 1915–1916, CHAP. 126a.]

2. *Rules and regulations of State board of health.*—* * * The board [State board of health] shall have authority to make such rules and regulations and such sanitary investigations as they may from time to time deem necessary for the preservation and improvement of the public health * * *. It shall be the duty of all local boards of health, health authorities, and officers, police officers, sheriffs, constables, and all other officers and employees of the State, or any county, village, city, or township thereof, to enforce the rules and regulations that may be adopted by the State board of health.

7. *Penalty for violation of such regulations.*—Any person who violates or refuses to obey any rule or regulation of said State board of health shall be liable to a fine not to exceed $200 for each offense or imprisonment in the county jail not exceeding[2] six months, or both, in the discretion of the court * * *.

[REVISED STATUTES, 1915–1916, CHAP. 144.]

29. *Establishment of survey of waters of State.*—The trustees of the University of Illinois are hereby authorized and directed to establish a chemical and biological survey of the waters of the State in connection with said university.

30. *Water samples to be analyzed.*—It shall be the duty of the university to collect facts and data concerning the water supplies of the State, to collect

[1] Law reads "country." [2] Law reads "exceed."

samples of waters from wells, streams, and other sources of supply, to subject these samples to such chemical and biological examination and analysis as shall serve to demonstrate their sanitary condition, and to determine standards of purity of drinking waters for the various sections of the State, to publish the results of these investigations in a series of reports to be issued annually, or oftener, to the end that the condition of the potable waters of the State may be better known and that the welfare of the people of the various communities of the State may thereby be conserved.

31. *Appropriation.*—For the installation and support of said survey there is appropriated the sum of $3,000 per annum.

[TYPHOID FEVER (REG. BD. OF H., FEB. 16, 1915).]

5. *Precautions.*—* * * All discharges from bowels and bladder [of typhoid-fever patient] must be received in a vessel containing a liberal quantity of an approved disinfectant. * * *

The discharges should never be emptied on the ground or into a stream. After thorough disinfection they may be emptied in the sewerage system, or if no such system exists, as in rural districts, they should be buried at least 1 foot below the surface of the ground and not closer than 150 feet to any well or other source of water supply. * * *

[WATERWORKS AND SEWERAGE SYSTEMS (REG. BD. OF H., APR. 5, 1916).]

RULE No. 1. No municipality, district, corporation, company, institution, persons or person shall install or enter into contract for installing waterworks or sewers to serve more than 25 persons until complete plans and specifications fully describing such waterworks or sewers have been submitted to and received the written approval of the State board of health, and thereafter such plans and specifications must be substantially adhered to unless deviations are submitted to and receive the written approval of the State board of health.

RULE No. 2. No municipality, district, corporation, company, institution, persons or person shall make or enter into contract for making any additions to or changes or alterations in any existing waterworks serving more than 25 persons, when such additions, changes, or alterations involve the source of supply or means for collecting, storing, or treating the water, until complete plans and specifications fully describing proposed additions, changes, or alterations have been submitted to and received the written approval of the State board of health, and thereafter such plans and specifications must be substantially adhered to unless deviations are submitted to and receive the written approval of the State board of health.

RULE No. 3. No municipality, district, corporation, company, institution, persons or person shall make or enter into contract for making alterations or changes in or additions to any existing sewers or existing sewage treatment works serving more than 25 persons until complete plans and specifications fully describing such alterations, changes, or additions have been submitted to and received the written approval of the State board of health, and thereafter such plans and specifications must be substantially adhered to unless deviations are submitted to and receive the written approval of the State board of health.

RULE No. 4. Any municipality, district, corporation, company, institution, persons or person owning or operating water purification works or sewage treatment works shall submit to the State board of health monthly records showing clearly the character of effluents produced.

RULE No. 5. No municipality, district, corporation, company, institution, persons or person shall offer lots for sale in any subdivision unless within the boundaries of an area incorporated as a municipality or sanitary district until complete plans and specifications for sewerage, drainage, and water supply have been submitted to and received the written approval of the State board of health, and thereafter such plans and specifications shall be substantially adhered to unless deviations are submitted to and receive the written approval of the State board of health.

RULE No. 6. No natural ice shall be furnished or vended to the public for domestic purposes until the source of the ice supply has received the written approval of the State board of health, which approval is revocable upon evidence being presented or discovered of undue contamination entering the source.

INDIANA.

[ANNOTATED STATUTES, 1914.]

2253. *Poisoning water supplies.*—Whoever poisons any spring, fountain, well, cistern, or reservoir of water with intent to kill or injure any human being, on conviction, shall be imprisoned in the State prison not less than 3 years nor more than 14 years.

2441. *What constitutes public nuisance.*—* * * whoever causes or suffers any offal, filth, or noisome substance to be collected or to remain in any place to the damage, prejudice, or discomfort of others or the public, or whoever obstructs or impedes, without legal authority, the passage of a navigable river, harbor, or collection of waters, * * * shall, on conviction, be fined not less than $10 nor more than $500: *Provided*, That nothing in this section shall prevent the board of trustees of towns and the common councils of cities from enacting and enforcing such ordinances within their respective corporate limits as they may deem necessary to protect the public health and comfort.

2443. *Putting carcasses into streams.*—Whoever puts the carcass of any dead animal, or the offal from any slaughterhouse or butcher's establishment, packing house, or fish house, or any spoiled meat or spoiled fish, or any putrid animal substance, or the contents of any privy vault upon or into any river, pond, canal, lake, * * * shall, on conviction, be fined not less than $1 nor more than $100.

2462. *Prohibiting placing carcasses in water supplies.*—Whoever maliciously or mischievously puts any dead animal, carcass or part thereof, or any other putrid, nauseous, noisome, or offensive substance, into or in any manner befouls any well, cistern, spring, brook, canal, or stream of running water, or any reservoir of water-works, of which any use is or may be made for domestic purposes, shall, on conviction, be fined not less than $5 nor more than $100, to which may be added imprisonment in the county jail, not less than 10 days nor more than 60 days.

2546. *Prohibiting placing trade wastes in waters of State.*—It shall be unlawful for any person, firm, or corporation to cause, suffer, or permit any dyestuff, acid, coal tar, oil, logwood, or any refuse matter or substance whatever to be thrown, run, or drained into any of the waters of this State in quantities sufficient to injure or destroy the lives of fish which may inhabit the same at or below the point where any such substances is [sic] discharged or permitted to flow into such waters. Whoever violates any of the provisions of this section shall, on conviction, be fined not less than $50 nor more than $1,000 for each offense, and each day's violation of the provisions of this section shall constitute a separate offense: *Provided*, That the provisions of this section

shall not abridge the rights of owners of gas or oil wells to drain the waters from such wells into the waters of the State, as now permitted by law.

2547. *Poisoning fish.*—Whoever throws or places in any stream, lake, or pond any lime or other deleterious substance, with the intent to injure fish, or any drug, medicated bait, cocculus indicus, or fish berries, with intent thereby to poison or catch fish, shall be fined not more than $50 nor less than $10.

7594. *Rules governing local health boards.*—The State board of health * * * shall have power * * * to pass rules governing the duties of all health boards and all health officers * * *.

7597. *State board of health to investigate pollution of water supplies.*—Whenever the common council, board of health of any city, or town, or the board of county commissioners of any county, or the trustee of any township, in this State, shall make complaint in writing to the State board of health, charging that any city, town, village, corporation, person, or firm named in said complaint is discharging, or is permitting to be discharged, any sewage or other wastes, or befouling or deleterious matter into any stream, watercourse, river, spring, lake, or pond, and is thereby materially injuring, for domestic use, the character of the water into which the same is discharged to the injury of public health or comfort, or is polluting the source of any public water supply, it shall be the duty of the State board of health to forthwith inquire into and investigate the conditions complained of, and if, upon such investigation, said board shall find the charges, or any of them, made in such complaint to be true, and that the conditions produced by the acts complained of are detrimental to public health or comfort, or to the comfort and health of persons residing in the vicinity of the water so befouled, it shall notify the person, municipality, corporation, or firm causing the pollution, of the board's finding, and, in the notice, shall fix a time for hearing. After such hearing, if the State board of health shall determine that the person, municipality, corporation, or firm should cease doing the acts complained of, it shall enter an order to that effect against the offender, and shall at the same time suggest such improvements or changes in the offender's works, plant, or property, if any said board knows of, as will render the noxious matter so being passed into the water innocuous and harmless, and shall require by its order the offender to adopt and apply the board's recommendations in that behalf before the offender shall again resume such use of the water, and such board shall in its order requiring the offender to discontinue the use of water, give to such offender a reasonable time to adopt, construct, and put in use the appliances so recommended by the board, and such order shall in each case indicate as a part thereof the time given to such offender: *Provided, however*, That in the event said board of health find that any offender is polluting the source of any water supply, the order of said board of health against such offender shall take effect immediately. The provisions of this section shall not apply to or be enforced against any city, town, village, or other municipality located on any stream, any part of which forms the boundary between the State of Indiana and another State, or any part of which flows from another State into the State of Indiana, so long as the unpurified sewage of cities, towns, villages, corporations, persons, or firms of such other States is permitted by law to be discharged into such streams upstream from such Indiana city, town, village, or other municipality.

7598. *State board of health may investigate water supplies believed to be polluted.*—Whenever the board of health or the health officer or 10 per cent of the electors of any city, town, or village in this State shall file with the State board of health a complaint in writing setting forth that it is believed that the public water supply of such city, town, or village is impure and dangerous to health, it shall be the duty of the State board of health forthwith to inquire

nto and investigate the charges made in such complaint, and if the State board of health upon such investigation shall find and determine that such public water supply is impure and dangerous to health, or that it is not sufficiently purified because of improper construction of works or inefficient management or operation thereof, or of inadequacy of the size of any works designed to purify such public water supply, said State board of health shall notify the municipality, corporation, or other person operating such water supply of the board's findings and give an opportunity to the offender to be heard. After such hearing, if the State board shall determine that improvements or changes are necessary in the works or plant of the offender to render the public water supply pure and healthful, it shall notify such municipality, corporation, or other person operating said water supply or works to make such changes as the State board of health may recommend as respects the source of the water supply or works as will render the water pure and healthful to the satisfaction of the State board of health, which changes shall be made within a reasonable time to be named by the State board of health.

7599. *State board of health may order improvements in waterworks.*—Whenever the State board of health shall, on investigation voluntarily instituted by it or instituted after complaint filed, as in sections 1 and 2 of this act mentioned, find that any water-purification works or sewage-purification works, by reason of incompetent or inefficient supervision or operation, are not producing an effluent as pure as might reasonably be obtained from these works, and that by reason thereof any public water supply has become impure or dangerous to health, or that any stream, watercourse, river, spring, lake, or pond has become materially polluted, or has become a public nuisance, said board shall issue an order to the municipality, corporation, or other person having charge of or operating such purification works requiring that the effluent thereof shall be made as pure as might reasonably be expected from such plant, if properly operated, and as shall be satisfactory to said board; and in such order said board shall name a reasonable time within which the order shall be complied with. If such order shall not within such time be complied with, the State board of health shall order the offender to appoint, within 10 days, a competent person, approved by said State board of health, whose salary shall be paid by the municipality, corporation, or firm to whom the order is addressed, to take charge of and to superintend the operation of such purification plant or works, to the end that the effluent of such works shall be made as pure as might reasonably be expected from them, when properly operated, and as shall be satisfactory to said State board of health.

7599a. *Appeal from orders of State board of health.*—If any order of the State board of health, made in pursuance to the provisions of sections 1, 2, or 3 of this act, shall not be acceptable to the municipality, corporation, or person against whom such order is made, then within 20 days after the service of such order such dissatisfied municipality, corporation, or person may, by written request to said State board of health, require it to submit the matter in dispute to two sanitary engineers, one to be selected by the State board of health and the other by the party making the request, and in case the two so selected are unable to agree they shall choose a third sanitary engineer, and a finding and report joined in by the two first chosen or by any two of the three, if a third engineer shall have been chosen, shall become the finding of the board and the basis of an order to be made by the board, and both shall stand and be in force as a finding and order of the board until appealed from as in this act provided. The sanitary engineers above mentioned shall be reputable and experienced and not regularly employed by either the State board of health

or the complainant, if any, or by the party requesting the reference to engineers. Such engineers shall pass upon and report in writing concerning the necessity and reasonableness of the order of the State board of health, making their report to the State board of health, and shall therein affirm, modify, or reject the existing order of the State board of health. Such finding and report shall be prima facie evidence of the facts therein contained and shall be treated as such in any appeal from the State board of health to a circuit or superior court as hereinafter provided. The report of the engineers shall be made to the State board of health within 30 days after the appointment of the last one of such engineers appointed, unless the State board of health shall, at the request of the engineers, extend the time. The State board of health shall accept such report and shall enforce it as an order of the board, unless an appeal shall be taken therefrom to the circuit or superior court as hereinafter provided. The fees and expenses of the reference to engineers shall be paid equally by the State board of health and by the person or corporation requesting the reference.

7599b. *Secretary State board of health to record proceedings of board.*—It shall be the duty of the secretary of the State board of health to keep a complete record, in a proper record book of the board, of all the proceedings of said board had in pursuance of any provision of this act and of all evidence taken by the board in such proceeding, including as a part of such record the findings and report of the sanitary engineers to be made as provided for in section 4 of this act [7599a]. Such record shall be a public record open to the public.

7599c. *Appeal from decision of the board.*—Anyone aggrieved by any order of the State board of health, made in pursuance of the provisions of this act, may appeal from such order to the circuit or superior court of the county wherein such purification works are located and wherein such polluting substance is alleged to be passed into the water, by filing with the secretary of the State board of health, within 20 days after service of the order to be appealed from, a written request that an appeal be granted, accompanied by a bond with sufficient freehold surety, conditioned for the payment of all costs of said appeal and for any damages that may flow from the suspension of the operation of said order appealed from pending the appeal if the party appealing shall be defeated in such appeal. Such appeal shall be perfected by filing with the clerk of such circuit or superior court a complete transcript of the record of the State board of health in the matter in which the appeal is taken. It shall be the duty of the State board of health, as soon as such appeal is prayed and such bond is given and approved by it, to cause such transcript to be made and certified by the secretary of the State board of health, and upon payment of the cost of such transcript, at the rate of 15 cents for each legal cap typewritten page thereof, to deliver the same to the appellant. Said cause on appeal shall be tried as a civil cause, de novo, by the court without the intervention of a jury, and an appeal shall lie from the decision of such circuit or superior court therein as in other civil causes. In such appeal the appellant may contest the necessity and reasonableness of such order of the State board of health. The court, on final hearing, shall affirm or overrule the order of the State board of health appealed from. If it shall affirm such order, the appellant shall be liable for all costs of such appeal and damages suffered while it was pending growing out of the suspension of the operation of the order appealed from, or the court may adjudge an equitable division of the costs and disallow damages as to it may seem just. If the court overrules the order appealed from, the appellant shall be relieved from the payments of costs and damages.

7599d. *Penalties.*—If any municipality or officer thereof upon whom the duty to act is cast, or any other corporation or officer thereof on whom the duty to

act is cast, or any person, shall fail or refuse for a period of 10 days after the expiration of the time fixed by the State board of health for compliance with its order, or in case of appeal or appeals for a period of 10 days after final judgment affirming the board's order shall have been entered, to obey the same or in good faith to begin to make the changes and improvements in the works as ordered by the State board of health, such municipality, corporation, officer, or person so failing or refusing shall become liable for and forfeit to the State of Indiana the sum of $500, to be recovered by the State in a civil action brought in said circuit or superior court by the State of Indiana on the relation of its attorney general, and such penalty when collected shall be paid into the State treasury for the use of the State.

7599e. *Disobedience of order of State board of health regarding disposition of sewage unlawful.*—It shall be unlawful for any municipality, after an order has been made against it by the State board of health requiring the construction of a filtration or sewage disposal plant in the form and manner hereinbefore set out in this act, to construct any sewer or drain designed to carry any substance or matter of a character to injuriously affect water for domestic use which shall, directly or indirectly, discharge into any stream, watercourse, river, spring, lake, or pond. It shall be unlawful for any person, firm, or corporation located within the corporate boundaries of any municipality against which any order has been made by the State board of health as hereinbefore provided requiring the construction of any filtration plant or sewage-disposal plant, or within 2 miles in any direction of the corporate boundaries of any such municipality, to construct any sewer or drain designed to carry any substance or matter of a character to injuriously affect water for domestic use which shall, directly or indirectly, discharge into any stream, watercourse, river, spring, lake, or pond, and all such sewers so constructed by any such firm, person, or corporation shall discharge into the sewer system of such municipality unless such person, firm, or corporation shall provide as a part of its said sewers or drains a plant for the filtration or purification thereof, and unless such filtration plant shall have been approved, in writing, by the State board of health: *Provided, however,* That nothing in any section of this act[1] shall give the State board of health power to direct any order against any person, firm, or corporation located within the corporate boundaries or within the police jurisdiction of any city for the pollution of any waters of the State of Indiana so long as such municipality shall also be using such waters as an outlet for its sewage system, unless it be charged and shown to such State board of health that such person, firm, or corporation is polluting the source of any public water supply, in which event the State board of health may proceed directly against such person, firm, or corporation regardless as to whether or not an order has theretofore been directed against the municipality within which such person, firm, or corporation is conducting its business. Nothing in this section or in this act is intended to enlarge the existing right of riparian owners or other persons to cast deleterious substances into streams and other waters sought to be protected by this statute, and this act shall not be construed to change the law, either common or statute, in this respect.

7599f. *Municipalities may, by assessment, provide means for sewage-purification works.*—All cities, towns, and other municipalities of this State are hereby given power to provide the means for paying the cost of constructing purification plants to purify the discharge of public sewers and drains now in existence or hereafter constructed by assessing the cost thereof against all of the several parcels of real estate situate within their corporate limits and to make each

[1] 7597–7599g.

assessment in a sum as great as but not greater than the value of the benefits received by each parcel, respectively, by reason of the construction of such plant. The statutes for the construction of public sewers and assessing the cost of the same against real estate in such municipalities, respectively, are hereby made applicable, as far as they can be, to the construction of such sewage-purification plants and the assessing of the cost thereof against real estate benefited thereby, and such cost may, at the option of the owner assessed, be paid in 10 equal annual installments, as in the case of assessments for such sewers.

7599g. *Penalties.*—Whoever violates any of the provisions of this act [1] or of any order, rule, or regulation of the State board of health made in pursuance of the provisions of this act, shall, upon conviction of such offense, be fined in a sum not greater than $1,000, to which may be added imprisonment in the county jail for not more than six months; and it shall be the duty of the attorney general and of the prosecuting attorneys of this State to prosecute for such violations.

7599h. *Duty of local board of health when water is impure.*—Whenever the board of health of any city or town, the county health officer, or citizens equal to 5 per cent of the electors of any city or town in this State shall file with the State board of health a complaint in writing, setting forth that the public water supply coming from any stream or body of water is not filtered and is not of the purity required by any law or ordinance in force at the time of the passage of this act, or that it is believed that the public water supply of such city or town is impure and dangerous to health, it shall be the duty of the State board of health forthwith to inquire into and investigate the charges made in such complaint, and if the State board of health upon such investigation shall find and determine that such public water supply is impure and dangerous to health, or that it is not filtered or is not sufficiently purified because of improper construction of works or inefficient management or operation thereof, or of inadequacy of the size of any works designed to purify such public water supply, or is not of the purity required by the laws of the State or ordinances of the city or town in force at the time of passage of this act, said State board of health shall notify the municipality, corporation, or other person operating such water supply of the board's findings and give an opportunity to the offender to be heard. After such hearing, if the State board of health shall determine that improvements or changes are necessary in the works or plant of the offender to render the public water supply pure and healthful, it shall notify such municipality, corporation, or other person operating said water supply or works to make such changes as the State board of health may recommend with respect to the works or to the source of the water supply as will render the water pure and healthful to the satisfaction of the State board of health, which changes shall be made within a reasonable time, to be fixed by the State board of health.

7599i. *Record of proceedings.*—It shall be the duty of the State board of health to keep a complete record, in a proper record book of the board, of all of the proceedings of said board had in pursuance of any provision of this act and of all evidence taken by the board in such proceeding.

7599j. *Penalty for neglect.*—If any municipality, or officer thereof upon whom the duty to act is cast, or any other corporation or officer thereof on whom the duty to act is cast, or any person shall fail or refuse, for a period of 10 days after the expiration of the time fixed by the State board of health for compliance

[1] 7597–7599g.

with its order, or in case of appeal or appeals for a period of 10 days after final judgment affirming the board's order shall have been entered, to obey the same or in good faith to begin to make the changes and improvements in the works as ordered by the State board of health, such municipality, corporation, officer, or person so failing or refusing shall become liable for and forfeit to the State of Indiana the sum of $500, to be recovered by the State in a civil action brought in said circuit or superior court by the State of Indiana on the relation of its attorney general, and such penalty, when collected, shall be paid into the State treasury for the use of the State, and each day's delay shall constitute a separate offense.

8655. *Powers of council to prevent pollution of streams.*—The common council of every city shall have power to enact ordinances for the following purposes:

Forty-eighth.—To keep rivers, streams, and other waterways open, and prevent the waters thereof from becoming polluted; jurisdiction for both of which purposes is given for 10 miles beyond the city limits. * * *

8961. *City to have exclusive control over its watercourses.*—Every city and town, except when otherwise provided by law, shall have exclusive power over the * * * watercourses, sewers, drains * * * within such city or town * * *.

IOWA.

[ANNOTATED CODE OF 1897, SUPPLEMENT OF 1913, SUPPLEMENTAL SUPPLEMENT OF 1915.[1]]

696. *Prevention of nuisances.*—They [cities and towns] shall have power to prevent injury or annoyance from any dangerous, offensive, or unhealthy, to cause any nuisance to be abated, * * * to establish all needful regulations as to the management of packing and slaughterhouses, renderies, tallow chandleries, and soap factories, bone factories, tanneries, and manufactories of fertilizers and chemicals within the limits of such cities and towns; to regulate and restrain the deposit and removal of all offensive material and substances * * *. In addition to any right of abatement of any public or private nuisance they shall have the right to prohibit the same by ordinance and to punish by fine or imprisonment for the violation thereof. (Supplement, 1913, to Code of 1897.)

723. *Municipal jurisdiction over waterworks.*—For the purpose of maintaining and protecting such works or plants [waterworks, etc.] from injury, and protecting the water of such waterworks from pollution, the jurisdiction of such city or town shall extend over the territory occupied by such works and all reservoirs, mains, filters, streams, trenches, pipes, drains, poles, wires, burners, machinery, apparatus, and other requisites of said works or plants used in or necessary for the construction, maintenance, and operation of the same, and over the stream or source from which the water is taken for five miles above the point from which it is taken. (Code of 1897.)

1056-a49. *Preventing pollution of meandered streams in cities of 2,000 or more inhabitants.*—Every city * * * [of 2,000 or more inhabitants] shall have control of all the meandered streams within the boundaries thereof, and of the beds, banks, and waters of such streams. Said cities shall have power to prevent the placing or maintenance of nuisances and obstructions in such streams, or on or along the banks thereof, and to abate and remove such nuisances or obstructions therefrom, and to recover the expense thereof from the

[1] Compilation from which section is taken is in each case indicated at the end of the section.

person or persons causing, placing, or maintaining such nuisances therein or thereon * * *. (Supplement, 1913, to Code of 1897.)

2540-a. *Prohibiting the use of certain materials to kill fish.*—It shall be unlawful for anyone to place in the waters of the State any lime, ashes, or drug of any kind or other substance, * * * with the intent to kill or so to affect any fish that it may be taken, and anyone guilty of any of said acts shall be guilty of a misdemeanor and upon conviction thereof be fined not less than $50 nor more than $100, or imprisoned in the county jail not less than 15 nor more than 30 days. (Supplemental Supplement, 1915, to Code of 1897.)

2565. *Regulations of State board of health.*—The board [State board of health] shall have * * * authority to make such rules and regulations and sanitary investigations as it from time to time may find necessary for the preservation and improvement of the public health, which, when made, shall be enforced by local boards of health and peace officers of the State * * *. (Code of 1897.)

2572. *Enforcement of regulations.*—Local boards of health shall obey and enforce the rules and regulations of the State board; and peace and police officers within their respective jurisdictions, when called upon to do so by the local boards, shall execute the orders of such boards. If any local board of health shall refuse or neglect to enforce the rules and regulations of the State board of health, the State board of health may enforce its rules and regulations within the territorial jurisdiction of such local board, and for that purpose shall have and may exercise all the powers given by statute to local boards of health; and peace and police officers of the State, when called upon by the State board of health to enforce its rules and regulations, shall execute the orders of such board * * *. (Supplement, 1913, to Code of 1897.)

4773. *Poisoning springs, etc.*—If any person * * * willfully poison any spring, well, cistern, or reservoir of water he shall be imprisoned in the penitentiary not exceeding 10 years, and be fined not exceeding $1,000. (Code of 1897.)

4945. *Prohibiting placing of human remains in water supplies.*—If any person * * * willfully and unnecessarily, * * * throw away or abandon any human body, or the remains thereof, * * * in any river, stream, pond, or other place, he shall be imprisoned in the penitentiary not more than two years or fined not exceeding $2,500, or both. (Code of 1897.)

4979. *Prohibiting placing of carcasses in streams.*—If any person throw, or cause to be thrown, any dead animal, night soil, or garbage into any river, well, spring, cistern, reservoir, stream, or pond, or in or upon any land adjoining which is subject to overflow, he shall be imprisoned in the county jail not less than 10 nor more than 30 days, or be fined not less than $5 nor more than $100. (Supplement, 1913, to Code of 1897.)

5078. *Pollution of streams a nuisance.*—* * * the corrupting or rendering unwholesome or impure the water of any river, stream, or pond * * * are nuisances. (Code of 1897.)

5081. *Penalty—abatement.*—Whoever is convicted of erecting, causing, or continuing a public or common nuisance as provided in this chapter [sec. 5078], or at common law, when the same has not been modified or repealed by statute, where no other punishment therefor is specially provided, shall be fined not exceeding $1,000, or be imprisoned in the county jail not exceeding one year, and the court, with or without such fine, may order such nuisance abated and issue a warrant as hereinafter provided.[1] (Supplement, 1913, to Code of 1897.)

[1] Process is described in sections 5082-5 of the Code of 1897, which are not given in this compilation.

[DISPOSAL OF SEWAGE AND GARBAGE (REG. BD. OF H., JULY 21, 1911).]

RULE VI, SECTION 1. No privy vault, cesspool, or reservoir into which a privy, water-closet, sink, or stable is drained, except it be water-tight, shall be established or permitted in water-bearing strata or within 100 feet of any well, spring, or any other source of water used for drinking or culinary purposes.

SEC. 2. All privy vaults, reservoirs, or cesspools named in section 1 shall be cleaned and emptied of their contents at least once every year, before the 1st day of May, and shall be kept thoroughly deodorized and disinfected by adding to the contents thereof, at least once each month or oftener if necessary, calcium hypochlorite, as follows: Take the calcium hypochlorite in powder form and sprinkle over the contents until the odor is abated, stirring contents if necessary. All privy vaults within the limits of any city or town shall not be less than 5 feet deep, and shall be constructed of brick set in cement or of concrete construction or 2-inch tight lumber.

SEC. 3. No privy vault, water-closet, cesspool, sink, or stable drain shall open into any ditch, stream, or drain, except into the public sewers of the city or into disposal tanks equipped with aerated contact or trickling filters of ample area.

SEC. 4. (*a*) All sewer drains leading to outfalls or disposal plants shall be constructed of standard vitrified sewer pipe or standard cement sewer pipe with the joints properly set in cement in such a manner as to make them water-tight; and no sewer drain or outlet from any sewage-disposal plant, except as hereinafter provided, shall empty into any lake, pond, creek, stream, or open field.

(*b*) Septic tanks or other disposal tanks shall be made of water-tight concrete or masonry construction. The filters of disposal plants, except in isolated locations in nonwater-bearing strata, shall be installed in basins with water-tight bottom and side walls.

All disposal plants not discharging their effluent into an established sewer system shall be provided with aerated filter beds constructed of proper filtering materials and of sufficient capacity to render the effluent clear and nonputrescible at all seasons of the year; provided, that in the case of country residences and other isolated locations the effluent from septic tanks or cesspools or other types of sewage disposal need not be subjected to filtration if such effluent can be discharged in sufficient isolation to prevent the creation of a nuisance or a menace to health; and in any case the pollution of any source of domestic or public water supply must be avoided.

(*c*) Nonputrescibility of effluents may be determined by means of the following:

1. The oxygen absorbed test.
2. The organic sulphur method.
3. The methylene blue test.
4. The method recommended by the Royal Commission on Sewage Disposal or by any of the standard chemical methods.

(*d*) If the effluent from the filters shall be discharged into any watercourse, open drain, stream, or pond, or source of water supply, or upon any lowland where, in any manner, by drinking the effluent or water polluted by it or by contact with the same, either by man or beast, pathogenic germs may be

transmitted, such effluent shall be sterilized by calcium hypochlorite or other suitable and safe chemical means.

(*e*) The discharge of the effluent from septic disposal plants or any other type of disposal plant into abandoned wells or into creviced strata, reaching water-bearing strata, from which domestic or public water supply is drawn, is absolutely prohibited.

(*f*) The different methods of irrigation and intermittent filtration are not intended to be excluded by the above requirements, but are also permitted and recommended where the conditions and surroundings will allow such methods of sewage disposal to be safely employed without creating a nuisance or menace to health and without polluting any source of domestic or public water supply.

SEC. 5. (*a*) No offal, slops, or other wastes from any creamery, factory, shop, chicken house, slaughterhouse, tannery, hotel, boarding house, restaurant, laundry, meat market, or private residence, or any other source, shall be thrown or deposited, except in accordance with properly provided garbage disposal, upon any lot or land, or into any ravine or open ditch, stream or pond or upon any land adjoining which is subject to overflow.

(*b*) Any of the wastes above mentioned, not properly disposed of as garbage and common sewage, shall be disposed of by independent disposal plants, which latter provision shall particularly apply to creameries, slaughterhouses, factories, and shops.

SEC. 6. (*a*) All dead animals and all decomposed animal matter shall be deodorized and immediately removed to dump grounds provided by the city and there buried at least 3 feet under ground.

(*b*) The dump grounds so used must be so located and of such a character as not to affect or contaminate any domestic or public water supply, either by overflow or percolation.

SEC. 7. No slops, offal, garbage, manure, or any other refuse shall at any time be deposited in any of the streets or alleys, or upon any lot in the city, except it be deposited in a regulation garbage box, as provided for in section 8 of this rule. All property owners shall be held responsible for the sanitary condition of the alley abutting on their premises.

SEC. 8. Each and all property owners within a city shall provide a suitable garbage box for each of his premises; said garbage box shall be so constructed as to be not more than 3 feet wide, 3 feet high, and 5 feet long and shall be made of tight-matched lumber or galvanized iron and shall stand at least 9 inches from the ground and shall be fitted with an attached cover which shall be fly proof and shall be kept closed.

SEC. 9. All garbage boxes and their contents shall be kept thoroughly deodorized, and the contents of all such boxes shall be removed at least twice each week, and oftener if so ordered by the health officer.

SEC. 10. All cellars, caves, and outbuildings shall be cleansed and disinfected at least twice each year, and all cattle yards, chicken yards, barns, or stables, when in use, shall be cleaned each day, and at all times kept free from all offensive odors.

SEC. 11. No privy vault shall be allowed upon any premises where there is a possible connection to the city sewer.

SEC. 12. A violation of any provision or section of this rule shall be deemed to be the commitment of a nuisance and shall subject the violator to the full penalty provided by statute and the ordinances of any city in Iowa having like regulations.

SEC. 13. It shall be the duty of the city marshal and other sanitary police officers to enforce these regulations, as herein set forth, under the supervision of the health officer.

KANSAS.

[GENERAL STATUTES, 1915.]

1107. *Health regulations by cities of first class.*—[The mayor and council of cities of the first class, i. e., cities with a population of more than 15,000, shall have power] to make regulations to secure the general health of the city; to prevent and remove nuisances; to regulate or prohibit the construction of privy vaults and cesspools and to regulate or suppress those already constructed; * * * to suppress hogpens; to regulate or suppress slaughterhouses and stockyards and prescribe and enforce regulations for cleaning and keeping the same in order * * *. (Sec. 1521 makes these provisions apply to the board of commissioners in cities of third class adopting commission form of government.)

1409. *City may enjoin nuisances.*—Any city may bring an action to enjoin and abate or prevent any nuisance that exists or is about to be created within the city or within 3 miles of its corporate limits.

1735. *Regulation of water supplies by cities of second class.*—The council [of cities of the second class, i. e., cities of more than 2,000 and not over 15,000 inhabitants] may establish, make, and regulate public wells, cisterns, aqueducts, and reservoirs, and provide for filling the same; and may establish, alter, change, straighten, divert, and otherwise improve the channels of watercourses, wall them, and cover them over * * *. (Sec. 1826 confers similar powers on boards of commissioners where commission form of government has been adopted.)

1737. *Council may remove nuisances, etc.*—The council [in cities of the second class] may * * * make regulations to secure the general health of the city and to prevent and remove nuisances and to provide the city and its inhabitants with water * * *.

1935. *Councils may regulate watercourses.*—The council [in cities of the third class] may establish, alter, and change the channels of watercourses and wall them and cover them over; and may establish, make, and regulate public wells, cisterns, aqueducts, and reservoirs of water, and provide for filling the same.

1937. *Council may enjoin nuisances, etc.*—The council [in cities of the third class] may * * * make regulations to secure the general health of the city and to prevent and remove nuisances and to provide the city with water.

3401. *Poisoning springs, etc.*—Every person who shall * * * willfully poison any spring, well, or reservoir of water shall, upon conviction, be punished by confinement and hard labor not less than 5 nor more than 20 years.

3698. *Deposition of dead hogs in water courses prohibited.*—Whoever shall throw or deposit a dead hog in any river, stream, creek, or ravine shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not exceeding $100.

3699. *Dead animal into well, etc.*—If any person or persons shall put any dead animal's carcass, or part thereof, into any well, or into any spring, brook, or branch of running water, of which use is made for domestic purposes, every person so offending shall, on conviction thereof, be fined in any sum not less than $2 nor more than $100.

3702. *Carcass into river, creek, etc.*—If any person or persons shall put any part of the carcass of any dead animal or domestic fowl into any river, creek, pond, * * * or if the owner or owners thereof shall knowingly permit the same to remain in any of the aforesaid places, to the injury of the health or to the annoyance or damage of the citizens of this State or any of them, every

person so offending shall, on conviction thereof before any justice of the peace of the county, be fined in a sum not less than $1 nor more than $25; and every 24 hours during which said owner may permit the same to remain thereafter shall be deemed an additional offense against the provisions of this act.

4941. *Unlawful to catch fish except by rod and line and fishhook.*—It shall be unlawful for any person to catch, take, or attempt to catch or take from any lake, pond, river, creek, stream, or other waters within or bordering on this State any fish by any means or in any manner except by rod and line and fishhook * * *. (Provisos do not alter effect of section in making illegal use of drugs, explosives, etc., for the purpose of taking fish. A more specific prohibition (sec. 3872 of General Statutes of 1909) was repealed when above was adopted, acts of 1911, chapter 198.)

10122. *Regulations of State board of health.*—* * * [The State board of health] are further empowered to make and enforce any regulations to obstruct and prevent the introduction or spread of infectious or contagious diseases to or within the State * * *.

10182. *Nuisances.*—The State board of health and the local boards of health shall have power and authority to examine into all nuisances, sources of filth, and causes of sickness that may, in their opinion, be injurious to the health of the inhabitants within any county or municipality in this State; and whenever any such nuisance, source of filth, or cause of sickness shall be found to exist on any private property or upon any watercourse in this State, the State board of health or local boards of health shall have power and authority to order, in writing, the owner or occupant thereof, at his own expense, to remove the same within 24 hours, or within such reasonable time thereafter as such board may order; and if the owner or occupant shall neglect so to do, he shall on conviction be fined not less than $10 nor more than $100, and each day's continuance of such nuisance or source of filth or cause of sickness, after the owner or occupant thereof shall have been notified to remove same, shall be a separate offense.

10183. *County attorney to prosecute.*—It shall be the duty of the county attorney of each county to prosecute any person who shall violate the provisions of * * * (sections 10182 and 10183).

10184. *Defining "waters of the State."*—The term "waters of the State," wherever used in this act [secs. 10184–10194], shall include all streams and springs and all bodies of surface and of impounded ground water, whether natural or artificial, within the boundaries of the State.

10185. *Water companies to file plans with State board of health.*—Every municipal corporation, private corporation, company, and individual supplying or authorized to supply water to the public, within the State, shall, within 60 days after the passage of this act, file with the State board of health a certified copy of the plans and surveys of the waterworks, with a description of the source from which the supply of water is derived, and no additional source of supply shall thereafter be used without a written permit from the State board of health, as hereinafter provided.

10186. *Permit to supply water for domestic purposes.*—No person, company, corporation, institution, or municipality shall supply water for domestic purposes to the public within the State from or by means of any waterworks that shall have been constructed or extended, either in whole or in part, subsequent to the passage of this act, without a written permit from the State board of health for the supplying of such water, except that this provision shall not apply to the extension of water pipes for the distribution of water. The application for such shall be accompanied by a certified copy of the maps, plans, and specifications for the construction of such waterworks or extension

and of a description of the source from which it is proposed to derive the supply, and of the manner of storage, purification, or treatment proposed for the supply previous to its delivery to consumers, together with such other data and information as may be required by the State board of health; and no other or additional source of supply shall subsequently be used for any such waterworks, nor any change in the manner of storage, purification, or treatment of the supply be made, without an additional permit, to be obtained in a similar manner from the State board of health. Whenever application shall be made to the State board of health for a permit under the provisions of this section, it shall be the duty of the State board of health to examine the application without delay, and as soon as possible thereafter to issue the said permit if, in its judgment, the proposed supply appears to be not prejudicial to the public health, or to make an order stating the conditions under which the said permit will be granted. If the said person, company, corporation, institution, or municipality shall consider the terms of such order to be illegal or unjust or unreasonable, it may, within 30 days after the making of such order, appeal therefrom to the district court of the county in which the proposed waterworks, or extension thereof, is to be located; and the said court shall hear the said appeal without delay and shall render a decision approving, setting aside, or modifying the said order, or fixing the terms upon which said permit shall be granted, and stating the reasons therefor. The supplying of water for domestic purposes to the public within the State from or by means of any waterworks that shall have been constructed or extended, either in whole or in part, subsequent to the passage of this act, without a permit to do so obtained from the State board of health as hereinbefore provided, shall be deemed a misdemeanor and shall be punishable by a fine of not less than $25 nor more than $50 for each offense. The supplying of water in each day contrary to the provisions of this act shall be considered to constitute a separate offense. Whenever complaint shall be made to the State board of health by the mayor of any city of the State, or by a county health officer or by a local board of health, touching the sanitary quality of any water supplied to the public for domestic or drinking purposes within the county within which the said city or health officer or local board of health is located, it shall be the duty of the State board of health to investigate the character of the water supply concerning which the complaint is made. Also, whenever the State board of health shall have reason to believe that the sanitary quality of any water supplied to the public within the State for domestic or drinking purposes is such as to be prejudicial to the public health it may, upon its own motion, investigate the character of such water supply. Whenever an investigation of any water supply shall be undertaken, under either of the foregoing provisions, it shall be the duty of the person, company, corporation, institution, or municipality having in charge the water supply under investigation to furnish, on demand, to the State board of health such information relative to the source or sources from which the said supply of water is derived and to the manner of storage, purification, or treatment of the water before its delivery to consumers as may be necessary or desirable for the determination of its sanitary quality. And the State board of health is hereby given authority to make an order requiring such changes in the source or sources of the said water supply, or in the manner of storage, purification, or treatment of the said supply, before delivery to consumers, or in both, as may, in its judgment, be necessary to safeguard the public health. It shall be the duty of the person, company, corporation, institution, or municipality having in charge the water supply investigated, or the works for the development or distribution of the supply, to fully comply with the said order of the State

board of health. If any such person, company, corporation, institution, or municipality shall consider the requirements of the said order to be illegal or unjust or unreasonable it may, within 30 days after the making of the said order, appeal therefrom to the district court of the county in which the said waterworks are located, and the said court shall hear the case without delay and shall render a decision approving, setting aside, or modifying the said order, or fixing the terms upon which said permit shall be granted, and stating the reasons therefor.

10187. *Prohibiting flow of sewage into waters of the State.*—No person, company, corporation, institution, or municipality shall place or permit to be placed or discharge, or permit to flow into any of the waters of the State, any sewage, except as hereinafter provided. But this act shall not prevent the discharge of sewage from any public sewer system owned and maintained by a municipality or sewerage company, provided such sewer system was in operation and was discharging sewage into the waters of the State on the 20th day of March, 1907; but this exception shall not permit the discharge of sewage from any sewer system that shall have been extended subsequent to the aforesaid date, nor shall it permit the discharge of any sewage which, upon investigation by the State board of health, as hereinafter provided, shall be found to be polluting the waters of the State in a manner prejudicial to the health of the inhabitants thereof. For the purposes of this act, sewage is hereby defined as any substance that contains any of the waste products or excrementitious or other discharges from the bodies of human beings, or animals, or chemical or other wastes from domestic, manufacturing, or other forms of industry.

Whenever complaint shall be made to the State board of health by the mayor of any city of the State, or by a county health officer, or by a local board of health, of the pollution or of the polluted condition of any of the waters of the State situated within the county within which the said city or health officer or local board of health is located, it shall be the duty of the State board of health to make an investigation covering the pollution or the polluted condition concerning which complaint is made. Also, whenever the State board of health shall have reason to believe that any of the waters of the State are being polluted in a manner prejudicial to the health of any of the inhabitants of the State, it may upon its own motion investigate such pollution. Whenever an investigation shall be undertaken by the State board of health under either of the foregoing provisions it shall be the duty of any person, company, corporation, institution, or municipality concerned in such pollution to furnish on demand to the State board of health such information as may be required relative to the amount and character of the polluting material discharged into the said waters by such person, company, corporation, institution, or municipality. And if the State board of health shall find that any of the waters of the State have been or are being polluted in a manner prejudicial to the health of any of the inhabitants of the State, the State board of health shall have the authority to make an order requiring such pollution to cease within a reasonable time, or requiring such manner of treatment or of disposition of the sewage or other polluting material as may, in its judgment, be necessary to prevent the future pollution of such waters, or both. And it shall be the duty of the person, company, corporation, institution, or municipality to whom such order is directed to fully comply with the said order of the State board of health. If the person, company, corporation, institution, or municipality shall consider the requirements of the said order to be illegal or unjust or unreasonable, it may, within 30 days after the making of the said order, appeal therefrom to the district court of the county in which the

pollution or polluted condition occurs; and the said court shall hear the said case without delay and shall render a decision approving, setting aside, or modifying the said order, or fixing the terms upon which said permit shall be granted, and stating the reasons therefor.

10188. *Permits to discharge sewage—how granted.*—Upon application duly made to the State board of health by sewerage companies or by the public authorities having by law the charge of the sewer system of any municipality, the governor of the State, the attorney general, and the secretary of the State board of health shall consider the case of such a sewer system, otherwise prohibited by this act from discharging sewage into any of the waters of the State, and whenever it is their unanimous opinion that the general interests of the public health would be subserved thereby, the secretary of the State board of health may issue a permit for the discharge of sewage from any such sewer system into any of the waters of the State, and may stipulate in the permit the conditions on which such discharge may be permitted. Such permit, before being operative, shall be recorded in the office of the recorder of deeds for the county wherein the outlet of the said sewer system is located. Every such permit for the discharge of sewage from a sewer system shall be revocable, or subject to modification and change, by the State board of health, on due notice, after an investigation and hearing, and an opportunity for all interested therein to be heard thereon, being served on the sewage company or on the public authorities of the municipality owning, maintaining, or using the sewage system. The length of time after receipt of the notice within which the discharge of sewage shall be discontinued may be stated in the permit, but in no case shall it be less than one year or exceed two years, and if the length of time is not specified in the permit it shall be one year. On the expiration of the period of time prescribed, after the service of a notice of revocation, modification, or change from the State board of health, the right to discharge sewage into any of the waters of the State shall cease and terminate; and the prohibition of this act against such discharge shall be in full force, as though no permit had been granted; but a new permit may thereafter again be granted, as hereinbefore provided.

10190. *Penalty.*—The penalty for the discharge of sewage from any public sewer system into any of the waters of the State without a duly issued permit, in any case in which a permit is required in this act, shall be $500 and a further penalty of $50 per day for each day the offense is maintained. The penalty for the discharge of sewage from any public sewer system into any of the waters of the State without filing a report, in any case in which a report is required by this act to be filed, shall be $50 per day for each day the offense is maintained.

10191. *Discharge of sewage may be ordered discontinued.*—All individuals, private corporations and companies that at the time of the passage of this act are discharging sewage into any of the waters of the State may continue to discharge such sewage unless, in the opinion of the State board of health, the discharge of such sewage may become injurious to the public health. If at any time the State board of health considers that the discharge of such sewage into any of the waters of the State may become injurious to the public health, it may order the discharge of such sewage discontinued.

10192. *Penalty.*—Any person, company, corporation, institution, or municipality who shall fail to furnish, on demand, to the State board of health such information as may be required by the said board under the provisions of this act[1] shall be deemed guilty of a misdemeanor, and, upon conviction, shall be punished by a fine of not less than $50 and not more than $500. Any person, com-

[1] 10184–10194.

pany, corporation, institution, or municipality who shall fail to fully comply with the requirements of the State board of health herein authorized to be made shall be deemed guilty of a misdemeanor, and, upon conviction, shall be punished by a fine of not less than $25 and not more than $100 for each offense. The failure to comply with such requirements in each day in which such failure is made shall be considered to constitute a separate offense.

10194. *Electors to vote on waterworks changes costing over $1,000.*—Nothing in this act [1] shall permit the board of health to change the supply of water for any municipal water plant where the cost of such change would exceed $1,000 without first submitting the same to the qualified electors at a general or special election.

[ANALYSES OF ICE WHEN SOLD FOR DOMESTIC PURPOSES (REG. BD. OF H., OCT. 4, 1915).]

1. Corporations or individuals selling artificial ice for domestic consumption shall submit to the water and sewage laboratory of the State board of health complete information concerning the source of water supply used for the manufacture of the ice and detailed description of the process involved.

2. A 50-pound cake of ice manufactured shall be sent to the water and sewage laboratory of the State board of health, Lawrence, Kans., each year for complete analysis. Results of these analyses shall be reported to the person whose name is signed to the information sheet and to the secretary of the State board of health.

3. Artificial ice shall contain less than 100 bacteria per cubic centimeter and no organisms of the bacillus coli group in 1 cubic centimeter. If the ice does not meet these requirements, it shall be sold for refrigeration purposes only and not for domestic consumption.

4. Corporations or individuals harvesting natural ice shall file full information with the water and sewage laboratory of the State board of health with regard to the source of the ice and the method of storage.

5. A 50-pound cake of the ice shall be shipped to the water and sewage laboratory of the State board of health during March or April each year for complete analysis.

6. Natural ice properly stored shall contain less than 100 bacteria per cubic centimeter and no organisms of the bacillus coli group in 1 cubic centimeter. If the ice does not meet these requirements, it shall be sold for refrigeration purposes only and not for domestic consumption.

7. County health officers shall furnish the water and sewage laboratory of the State board of health with lists of ice dealers in their districts.

8. Fees for the services rendered under these rules and regulations pertaining to ice supplies shall be payable by the manufacturer or owner of the ice plant January 1 of each year to the director of the water and sewage laboratory of the State board of health at the University of Kansas, Lawrence, Kans.

9. Fee shall be $15 annually for each source of supply of ice which is sold for domestic consumption.

[PRIVIES, CESSPOOLS, AND DRAINS—OFFENSIVE TRADES (REG. BD. OF H., MAR. 20. 1916).]

RULE 1. *Abandoned wells.*—The use of abandoned wells as cesspools is prohibited.

RULE 2. *Concerning privy vaults, cesspools, etc.*—No privy vault, cesspool, or reservoir into which a privy vault, water-closet, stable, or sink is drained, except it be water-tight, shall be permitted within 50 feet of any well, spring, or other

[1] 10184–10194.

source of water used for drinking and culinary purposes; nor shall any such open into any stream, ditch, or drain, except common sewers, nor shall any such be drained into an underground flow of water or water stratum which is used as a source of water supply.

RULE 3. *Drains.*—All drains carrying domestic sewage containing human or animal excreta passing within 50 feet in ordinary soil, or 80 feet in sandy soil, of any source of water supply shall be water-tight.

RULE 4. *Refuse matter; nuisance.*—The collection of refuse matter in or around the immediate vicinity of any dwelling or place of business, such as swill, waste of meat, fish or shells, bones, decaying vegetables, dead carcasses, excrement, or any kind of offal that may decompose and generate unhealthy gases, and thus affect the purity of the air, shall be considered a nuisance, and must be removed or disposed of, either by burial, burning, or otherwise, and in such manner as not to be offensive.

RULE 5. *Piggens.*—No pigpen shall be maintained within 100 feet of any well or spring of water used for drinking purposes, or within 30 feet of any street or 50 feet of any inhabited house. Such pens shall be kept in such a manner as not to be offensive by being freely deodorized at short intervals. No swine shall be kept within the limits of any incorporated city between May 1 and November 1 of any year.

RULE 6. *Unwholesome manufactory.*—No person or company shall maintain any manufactory or place of business, such as tanneries, establishments for boiling bones of dead animals, manufacturing of fertilizer, rendering plants, etc., where unwholesome, offensive, or deleterious odors, gases, smoke, or exhalations are generated, except such establishments shall be kept clean and wholesome; nor shall any offensive or deleterious or waste substance, refuse, or injurious matter from such establishments be allowed to accumulate upon the premises, or be thrown or allowed to run into any public waters, stream, watercourse, street, road, or public place; and every person or company conducting such manufactory or business shall use all reasonable means to prevent the escape of smoke, gases, and odors, and to protect the health and safety of all operatives employed therein.

KENTUCKY.

[CARROLL'S KENTUCKY STATUTES, 1915.]

1278. *Polluting watercourse, spring or pond.*—If any person shall cast or place the carcass of any cattle, or that of any other dead beast, in any watercourse, or within 25 yards thereof, or shall cast the same into any spring or into any pond, such person, for every such offense, shall be fined for the first offense not less than $5 nor more than $20 and every subsequent offense not less than $20 nor more than $100.

2049. *Regulations of State board of health.*— * * * [The State board of health] are * * * empowered to make and enforce rules and regulations to obstruct and prevent the introduction or spread of infectious or contagious diseases to or within the State. * * *

2057. *Boards may examine into causes of disease.*—The State board of health and the local boards shall have power and authority to examine into all nuisances, sources of filth, and causes of sickness that may in their opinion be injurious to the health of the inhabitants within any county in this State or in any vessel within any harbor or port in any county in this State; and whenever any such nuisance, source of filth, or cause of sickness shall be found to exist on any private property or in any vessel within any port or harbor of any county in this State, or upon any watercourse in this State, the State board of health

or local board of health shall have power and authority to order, in writing, the owner or occupant thereof, at his own expense, to remove the same within 24 hours or within such reasonable time thereafter as such board may order, and if the owner or occupant shall neglect so to do he shall be fined not less than $10 nor more than $100, and each day's continuance of such nuisance, or source of filth, or cause of sickness, after the owner or occupant thereof shall have been notified to remove the same, shall be a separate offense.

[ACTS OF 1916, CHAP. 29.]

SEC. 3. *Poisoning public waters.*—Any person or persons who shall place, or cause to be placed, in any of the public waters of this State any * * * liquid, berries, powder, medicine, or other thing, * * * whereby fish, great or small, may be sickened, intoxicated, or killed, or the water rendered unfit for use, or stench be produced, shall be fined not less than $50 nor more than $100 for each offense.[1]

[PRIVIES FOR PLACES OF PUBLIC RESORT (REG. BD. OF H., SEPT. 8, 1912).]

RULE 20½. All schools, health resorts, hotels, railway stations, courthouses, and other places of public resort and use not connected with an approved system of sewerage shall, on or before January 1, 1913, construct privies upon or convenient to their premises, proportioned in size and number to the persons and sex of those likely to use the same, the privies to be located below the level or draining away from or remote as possible from the well or spring and to be modeled after the Kentucky sanitary privy or some other plan approved by the State board of health.

LOUISIANA.

[REVISED CIVIL CODE, 1912.]

660. *Natural drainage.*—It is a servitude due by the estate situated below to receive the waters which run naturally from the estate situated above, provided the industry of man has not been used to create that servitude.

The proprietor below is not at liberty to raise any dam or to make any other work to prevent this running of the water.

The proprietor above can do nothing whereby the natural servitude due by the estate below may be rendered more burdensome.

---

[1] Section 10 of this act reads: "All laws and parts of laws, general, special, or local, in conflict with the provisions of this act as to the fish laws of this State, are repealed in so far as they so conflict herewith."

Certain sections in the Kentucky Statutes of 1915 which are wholly or in part replaced or repealed by this act follow:

1253. If any person put, or cause to be put, in any stream, dam, pool, or pond any liquid, berries, powders, medicine, or other thing, * * * whereby fish, great or small, are or may be sickened, intoxicated, or killed, or the water rendered unfit for use, or stench be produced, he shall be fined not less than $10 nor more than $100, and imprisoned in the county jail not less than 30 days nor more than 6 months, in the discretion of the jury, for each offense.

1895. Any person or persons who shall place or cause to be placed in any of the waters of this State any drug, poisonous substance, or medicated bait, with intent thereby to injure, poison, or catch fish, shall be guilty of a misdemeanor and on conviction thereof shall be fined not less than $20 nor more than $50 for each offense.

1900. Any person or persons who shall place, or cause to be placed, in any of the running waters designated in section 1899 [all public running waters] any drug, injurious substance, medicated bait, * * * with intent to injure, poison, or catch fish, shall be guilty of a misdemeanor and on conviction thereof shall be fined not less than $50 nor more than $100 for each offense, and cost of prosecution.

661. *Use of flowing water.*—He whose estate borders on running water may use it as it runs for the purpose of watering his estate or for other purposes.

He through whose estate water runs, whether it originates there or passes from lands above, may make use of it while it runs over his lands; but he can not stop or give it another direction, and is bound to return it to its ordinary channel where it leaves his estate.

695. *Necessary or well.*—He who wishes to dig a necessary or well against a wall, whether held in common or not, is bound to build another wall 1 foot thick; and when there is a well on one side and a necessary on the other there shall be 4 feet of masonry betwixt the two, including the thickness on both sides; but between two wells 3 feet interval are [sic] sufficient.

[REVISED STATUTES, 1915.]

679. *Sanitary code.*— * * * It [the State board of health] shall prepare or cause to be prepared a sanitary code for the State of Louisiana which shall contain and provide rules and regulations and ordinances of a general nature for the improvement and amelioration of the hygiene and sanitary condition of the State * * * and said code shall contain general rules in regard to such health, sanitary, and hygienic subjects, as can not, in the opinion of the State board of health, be efficiently and effectively regulated by the local boards. * * *

693. *Inspector of buildings and premises.*—It shall be and is hereby made the duty of the board of health in the city of New Orleans, to make, or cause to be made, a thorough and complete inspection of all buildings and premises within the limits of the city of New Orleans, occupied or used as dwelling houses, boarding houses, tenement houses, lodging houses, hotels, or private residences * * * to ascertain and determine whether such premises have, or possess, sufficient or adequate water supply, or means of water supply necessary for health and cleanliness, as provided in this act * * *.

694. *State supply.*—It shall be and is hereby made the duty of the owner of any premises or building, situated within the limits of the city of New Orleans, described or referred to in * * * [sec. 693] to provide and furnish every such premises and building with adequate water supply, by means of either suitable hydrant connection with the system of public-water supply or waterworks in said city, with cistern capacity for receiving, holding, and storing at least 200 gallons of water for each and every habitable room in the buildings, on said premises, excluding in such estimate all rooms not in the main building or buildings on said premises, unless such room, situated in a wing or outhouse, shall be used as a sleeping room or for lodgers, and in case there shall be any stable or place for stabling animals on said premises, in actual use for said purposes.

695. *Where owners do not live in New Orleans, etc.*—In all cases where the owner or owners of the property and premises referred to in this act shall not reside in the city of New Orleans, or where such property shall belong to an estate, succession, or corporation, it shall be the duty of the agent or representative of the owners thereof, or the person who shall have charge of said property for the owner thereof, or who shall collect the rent of such premises, if the same are under lease, to provide and furnish to such premises the adequate means of water supply by hydrant or cistern at the expense of the true owner or owners thereof, upon notice of any deficiency in that respect as provided in this act; and in case such person or representative of the owner shall fail or neglect to supply the same to such premises after due notice thereof, as provided in this act, such person shall be liable to all the fines and penalties prescribed in this act.

696. *Owners of premises to install water supply.*—When the board of health shall be satisfied, from the inspection provided for in this act, that any building or premises has not been, by the owner or owners thereof, furnished and provided with the adequate means of water supply required by this act, and that any building or premises is deficient in that respect, the board of health shall cause the owner of such premises or the agent or representative of said owner, in the event said owner is not a natural person or is not at the time within the city of New Orleans, to be notified of such defect or deficiency in water supply on such premises, and if such premises shall remain so deficient in means of water supply more than 15 days after such notification, maliciously or through negligence of the owner thereof, the owner of such premises or the person who represents such owner or owners shall be liable to a fine of $25, and the further fine of $10 for each and every month during which such person shall allow such premises to so remain deficient in means of water supply.

698. *Penalties.*—It shall be the duty of the board of health to cause all persons guilty of or charged with any violation of the provisions of this act to be arrested and taken before the recorder's court having jurisdiction of offenses against the ordinances and regulations of the city of New Orleans or such tribunal as may hereafter be created having such jurisdiction to hear and determine offenses prescribed by the ordinances and regulations of the city of New Orleans, and said court shall hear and determine such charge and complaint in a summary and prompt manner, and if such court shall find the accused guilty of any offense described in this act, said court shall condemn such offender to pay the sum prescribed by this act as a penalty for such offense, and in the event that such fine is not at once paid and satisfied, with costs, it shall be the duty of such court to remand offender to the parish prison in said city until such fine and costs are paid: *Provided*, that no person shall be detained and kept in custody for the nonpayment of any such fine longer than 10 days for each fine or offense, and it shall be the duty of such court to keep a separate book in which shall be entered the true and exact amount of all fines recovered for violations of this act; the date when the fine was imposed and when collected, and shall pay the same over to the secretary of the board of health, and take his receipt therefor, which shall be his voucher for such payment.

1853. *Depositing carcasses in streams.*—It shall be unlawful for any person or persons to throw or cause to be thrown into the rivers, bayous, or lakes of this State the carcass of any dead animal.

1854. *Penalties.*—Any person or persons found guilty of throwing into the rivers, bayous, or lakes of this State any dead animal contrary to the provisions of this act shall be guilty of a misdemeanor and upon conviction shall be fined not more than $25 or imprisoned in the parish jail not more than one month, or both, at the discretion of the court.

1859. *Prohibiting willful contamination of public water supplies.*—It shall be and it is hereby declared unlawful and a misdemeanor to knowingly and willfully contaminate any stream, wells, lake, pond, or body of water from which the public water supply of any city of this State is taken, by knowingly and willfully placing or causing to be placed therein the dead body of any animal or animals or any offensive or filthy matter, or from doing any other act tending to corrupt, injure, or contaminate said water supply; or for anyone knowingly and willfully to permit to escape or drain from his premises into said water supply any substance or fluid tending to contaminate or injure said water supply, or willfully and knowingly to permit to escape from his premises or property any sewerage [sic] or fluid into the said water supply that would injure the quality of the said water or contaminate it.

1860. *Penalties.*—For each and every violation of this statute there shall be imposed a fine of not less than $5 nor more than $100, or imprisonment not less than 1 day nor more than 30 days in the parish jail; one or both at the discretion of the court.

1863. *Prohibiting befouling of water supplies.*—It is hereby declared unlawful and a misdemeanor for any officer, manager, or employee of any corporation or any person acting for himself, or for anyone else to knowingly and willfully empty or drain into, or permit to be drained from any pumps, reservoir, wells, or oil fields into any of the natural streams or drains of the said State, from which water is taken for irrigation purposes any oil, salt water, or other noxious or poisonous gases or substances which would render said water unfit for irrigation purposes or would destroy the fish in said streams: *Provided,* That the operators or owners of wells shall have the right to turn their water from wells, reservoirs, or tanks into the rivers, bayous, streams, or other waterways, between September 1 and March 1 of each year, and are prohibited from doing so between March 1 and September 1 of each year. Said owners or operators shall provide reservoirs or tanks and shall keep the water out of the said streams or waterways during the close season, and shall pay for a watchman night and day to prevent leaks, breaks, secret pipes or violations of this law. It shall also be the duty of said operators or owners to plainly indicate to whom each reservoir or tank belongs by posting same, and shall be subject to inspectioin at all times by the legal authorities.

1864. *Penalty.*—For each and every violation of said act [sec. 1863] there shall be imposed upon any person so offending, whether acting in his individual capacity or for others, a fine not less than $100 nor more than $2,000, or imprisonment in the parish jail not less than 30 days nor more than three months in the discretion of the court trying the same.

1865. Each[1] and every day that said oil, salt water, or other substances is permitted to flow into such streams, shall constitute a separate offense.

3319. *Unlawful to puddle waters.*—It shall be unlawful for any person to muddy or "puddle" any waters for the purpose of taking fish thereby.

3321. *Puting drugs, etc., into streams.*—In order to prevent the killing of fish, it shall be unlawful for any person * * * to throw or place acids, or lime which have[2] not been used in manufacturing or commercial processes, india berries, sawdust, green walnuts, walnut leaves, or any other deleterious substance into, or on, or where it will run into the waters of the bayous, lagoons, ponds, lakes, bays, rivers, sound, or in the Gulf of Mexico within the territory of jurisdiction [territorial jurisdiction ?] of this State.

3322. *Penalty.*—Any person violating the provisions of the foregoing section shall be deemed guilty of a misdemeanor and shall, on conviction thereof, pay the costs of the prosecution and be imprisoned in the parish jail for not less than five days nor[3] more than 12 months, at the discretion of the court, and subject to work on the public roads as provided by law, and, in the event of the costs not being paid, an additional day for each day of the jail sentence shall be decreed by the court.

5147. *New Basin Canal may not be used as drain.*—* * * It shall be the special duty of the board of control and the superintendent [of the New Basin Canal] to see that the New Basin Canal is not used for drainage purposes by the city of New Orleans, or any part thereof, or by any corporation or individual whatsoever. It is hereby specially made their duty to have all inlets

[1] Text reads "For each."
[2] Text reads "has."
[3] Text reads "and."

which serve for drainage into said canal, and particularly what is known as the Louque Cut, closed at the expense of the city or other party responsible therefor. * * *

The board of control is specially authorized to sue for and recover damages caused by any drainage into the canal, and empowered by injunction or other legal proceeding to protect the canal from such use.

7104. *Waters in all bayous, etc., are the property of the State.*—The waters of and in all bayous, lagoons, lakes, and bays, and the beds thereof, within the borders of the State not at present under the direct ownership of any person, firm, or corporation are hereby declared to be the property of the State. There shall never be any charge assessed against any person, firm, or corporation for the use of the waters of the State for municipal, agricultural, or domestic purposes.

7105. *Water and beds of navigable streams are the property of the State.*—While acknowledging the absolute supremacy of the Federal Government over the navigation on and in the navigable waters within the borders of the State, yet nevertheless it is hereby declared and affirmed that the ownership of the water itself and the beds thereof in said navigable streams is vested in the State, and that the State has the right to enter into possession of said waters when not interfering with the control of navigation exercised by the Federal Government thereon: *Provided* this act [secs. 7104 and 7105] is not intended to interfere with the acquisition in good faith of any waters or the beds thereof transferred by the State or its agencies prior to the passage of this act; *Provided further*, This act shall not affect the acquisition of property by alluvion or accretion.

[ACTS OF 1917, P. 18.]

SECTION 1. *Penalty for damaging water supplies used for troops.*—Any person who shall interfere with, damage, or injure any source of supply for water * * * for troops in the employment of the State of Louisiana or of the United States shall be punished by a fine of not less than $500 nor more than $5,000, and by imprisonment in the penitentiary for not less than one year nor more than five years.

[OYSTERS AND OYSTER HOUSES. (REG. BD. OF H., DEC. 26, 1912).]

574. (*a*) It is unlawful to ship or sell oysters or other shellfish to which water has been added, either directly or in the form of melted ice.

(*b*) It is furthermore unlawful to ship, sell, or have in possession for sale within this State oysters or other shellfish which have become contaminated or polluted because of having been taken from insanitary or polluted beds, or because of having been packed under insanitary conditions, or because of having been handled in an uncleanly or insanitary manner.

(*j*) Toilet facilities must be provided, but they must be so located and constructed that there will be no danger of pollution from this source, and the closet must be kept clean.

[REG. BD. OF H., FEB. 26, 1913.]

Sanitary Code amended by adding section 398 (*b*):

SEC. 398. (*b*) All regulations regarding stables, the storing of manure, garbage, and refuse and the sanitation of places where animals are kept shall be equally applicable to rural localities, however isolated, as to neighborhoods, municipalities, towns, and cities.

[WATER SUPPLIES. (REG. BD. OF H., AUG. 20, 1918).]

The Sanitary Code was amended by adding the following to chapter 13, on page 102:

"Whenever any person or corporation furnishing water for potable purposes finds it necessary for any reason whatever to make any change, temporary or permanent, in the operation of their plant or in the manner of furnishing such water, which may in any way, either temporarily or permanently, tend to deteriorate the potable qualities of the water so furnished, by pumping directly into reservoirs or supply mains untreated water, when the ordinary supply is subjected usually to some form of purification treatment, or any other similar or dissimilar change in said supply, the tendency of which is to cause polluted waters to be forced into distributing pipes, the said person or corporation, before making such changes, or, in case of emergency, requiring the immediate making of changes in the operation of the plant, or in the manner of furnishing such water, within six hours of making such change, shall notify the local board of health, and shall also notify by telegraph or telephone the State board of health as to character and estimated duration of such change."

By amending paragraph 279 so as to read as follows: "It shall be unlawful for any person to use water from any canal, sewer, ditch, or other excavation in the ground within the limits of any city, except such wells as have been approved by the State board of health, for the purpose of making bread or any other article intended for human consumption or subsistence; nor shall any person use the water so procured for the purpose of washing or cleansing implements or utensils used in the preparation, manufacture, or vending of any article or commodity intended for or used as human food or drink."

In paragraph 281, by inserting before the word "well" in the first line the word "shallow."

(The paragraph as amended reads as follows:)

"281. It is hereby made unlawful to excavate or sink a shallow well on any premises used as a bakery or bake shop."

In paragraph 282: By changing last clause to read "that nothing herein shall be construed as prohibiting the boring of deep or artesian wells."

(The paragraph as amended reads as follows:)

"282. Upon any such premises where a well now exists, it shall be the duty of the owner of the property to cause same to be immediately filled up to the surface of the ground: *Provided*, That nothing herein shall be construed as prohibiting the boring of deep or artesian wells."

By inserting in chapter 13 the following:

"It shall be the duty of the mayor of each city, and of the proper officers of all private corporations, partnerships, and of individuals who shall hereafter install a waterworks system, or shall make any changes in any existing system, to file with the State board of health a true and correct copy of the plans and specifications of the entire system to be installed or changed by such city, corporation, partnership, or individual, including plans and specifications of such filtration or other purification plant as may be operated by them in connection therewith, and also plans and specifications of all alterations, additions, or improvements to such systems which may be made from time to time.

"The words 'plans and specifications' as used here shall be construed to mean a true description or representation of the entire system and also a full and fair statement of how the same is to be operated and, in addition to all other things, shall show all the sources through or from which water is or may be at any time pumped or otherwise caused or permitted to enter such system. Such plans and specifications shall be certified by the mayor and the

city engineer of city corporations, and by such proper officers and the engineer employed by a private corporation for private corporations, and by some individual member of a partnership, or by the individual owner in case of a waterworks owned and operated by partnerships or individuals, including the engineer employed, if any."

On receipt of the plans and specifications by the State board of health they will be inspected with reference to their effect on the public health, and if such board on inspection finds that the proposed water supply is impure and dangerous to individuals or to the public generally, or that the proposed purification system is inadequate to supply a safe water, the said board on its order may require the corporation, partnership, or individual owning and operating the same to make such alterations in such waterworks systems as may be required or advisable in the opinion of said board, in order that the water supply may be healthful and free of pollution. Such recommendations or orders of the State board of health shall be served in writing on such corporations, partnerships, or individuals, and it shall thereupon be the duty of such corporations, partnerships, or individuals to comply with such recommendations or orders.

[SEWERAGE SYSTEMS. REG. BD. OF H., AUG. 20, 1913.]

The sanitary code was amended by inserting under regulations concerning drains and sewers the following:

It shall be the duty of the mayor of each city and of the proper officer of all private corporations, partnerships, and of individuals who shall hereafter install a sewerage system for any city or town in the State, or shall make any additions or changes in existing system, to file with the State board of health a true and correct description of such system. Such plans and specifications shall, upon their receipt by the State board of health, be inspected with reference to their effect upon the public health, and if such board finds that such sewerage systems or any part thereof are dangerous to individuals or to the public health generally, the said board on its order may require such alterations as may be required or advisable.

[TOILETS AND URINALS. REG. BD. OF H., AUG. 20, 1913.]

The sanitary code was amended by adding to chapter 18, paragraph 413: "Toilets and urinals shall be in a space which is well lighted and well ventilated and which is separated from space used for any other purpose by walls extending from floor to ceiling. Doors to toilet rooms must fit tightly and be self-closing, except when doors open to outside of building or to open court."

[CONSTRUCTION AND CARE OF PRIVIES. REG. BD. OF H., AUG. 20, 1913.]

The sanitary code was amended by substituting for section 366 the following as section 366:

No privy or water-closet shall hereafter be maintained or built except such as are so constructed as to render them fly proof and easily cleaned. They shall be of wood, brick, or other material approved by the Louisiana State Board of Health, as follows:

(*a*) The floor shall be solid and water-tight, covering the entire base of the building inside the walls.

(*b*) The house shall be without cracks through which flies may enter. It shall be provided with a tight self-closing door and shall be lighted and ventilated by one or more openings, said opening or openings to give space not less than 4 square feet; all openings, whether for ventilation or otherwise, which

are not provided with doors, windows, or shutters shall be screened with 18-mesh cross wire per inch. Doors shall be kept closed.

(*c*) The roof of each privy or earth closet shall be water-tight, and if sloped to the rear of the house it shall project not less than 6 inches beyond the rear wall of the house.

(*d*) The seat shall have a self-closing hinged cover over the box opening. That flies may be excluded, the compartment under the seat, in which stands the night-soil container, shall be tightly constructed of sound lumber without cracks or crevices. Any opening in this compartment for ventilation shall be screened with 18-mesh crossed per inch wire.

(*e*) The box, tub, or can soil container shall be strongly constructed. It shall rest on the floor of the privy in such a position that its top shall not be more than 1 inch below the under surface of the closet seat. Whenever such box, tub, or can container shall cease to be water-tight it shall be replaced by a sound one.

(*f*) There shall be at the back or side of each privy an opening for the removal of the night-soil container, which opening shall be provided with a tightly fitting let-down board, or 18-mesh cross wire per inch cover, hinged to the house and so constructed as to prevent the access of flies to the night soil. This cover shall be provided with a hook or button and shall always be kept closed. Where practicable, the opening shall abut on a public alley so as to be readily accessible to the city scavenger.

(*g*) No privy shall be built or maintained within 20 feet of the line of any street or any house, or within 50 (preferably 100) feet of any well, or within 3 feet of the party line of the adjacent lot or lots, except in the rear or side of lots where they abut on the public alley.

(*h*) Whenever, in the opinion of the State board of health, the condition of any privy is such that it can not be put in sanitary condition the State board of health shall order a new privy constructed in conformity with the foregoing regulations.

(*i*) All privies shall be kept clean at all times. The excrement shall be removed at least once each week, seat scoured, and building thoroughly cleaned so as to prevent objectionable odors. The door of the house must not be left open.

(*j*) No wash water, garbage, kitchen slops, or other liquid waste shall be emptied into the privy. No night soil from any person suffering from typhoid fever or other serious bowel trouble shall be emptied into any privy without being previously disinfected in such manner as directed or approved by the State board of health.

(*k*) Every hotel, restaurant, residence, sleeping apartment, factory, mill, store, workshop, mercantile establishment, theater, picture show, or other places where people are employed, live, or congregate shall be provided with one or more privies, one seat for every 25 or fraction thereof, with separate apartments for the sex and color, and they shall be provided with proper wash and dressing rooms with an abundance of water, soap, and individual towels, and kept at all times in a cleanly state and free from effluvia arising from drain, privy, or otherwise. In public places, stores, etc., the privies shall be plainly designated for color and sex, provided with a supply of toilet paper, and no person shall be allowed to enter or use any such closet or privy assigned to persons of the other color or sex.

(*l*) Where there is an established system of waterworks and sewer system, all privies located on premises within 300 feet of sewer main or lateral shall be connected with the waterworks and sewer.

[DISCHARGE OF WASTE INTO WATERS. REG. BD. OF H., MAY 19, 1914.]

Section 365 of chapter 15 of the sanitary code was amended so as to read as follows:

"No person, persons, company, or corporation shall cause, permit, or allow any sewage, drainage, factory refuse, or any foul or offensive liquid or other material to flow, leak, escape, or be emptied or discharged into the waters of any river, stream, canal, harbor, bay, or estuary, or into the sea within the city limits, excepting below low-water mark, and in such manner and under such conditions that no nuisance can or shall be caused thereby or as a result thereof.

"The discharge of skimmings, filter-press mud, filtrates, acid, or alkali wash waters, spoiled sirups, or of other polluting materials, from plants making or refining sugar, into lakes, rivers, bayous, or other streams is prohibited.

"The above waste shall be discharged onto fields so that the liquid portion thereof will filter through the soil before reaching the drainage ditches.

"All sugar houses must be equipped with the necessary equipment, such as collecting vats, pumps, and piping, to carry out this regulation.

"This regulation shall not apply where the wastes are discharged into the Mississippi River or into ditches leading to swamps or bayous where, in the opinion of the State board of health, no nuisance or menace to health will result from such discharge."

[WATER SUPPLIES. REG. BD. OF H., APR. 11, 1916.]

Section 285 of chapter 13 of the Sanitary Code of Louisiana has been amended by adding the following paragraphs:

285 (*a*). When water supply of any village, town, city, railroad station, public or office building, water tank or water plant, or any source of supply for human consumption is examined by the State board of health and found unfit for human consumption the public shall be notified by the posting on source of condemned supply a warning metal sign (not less than 6 by 12 inches) with red background and white letters that may be read at 120 feet.

285 (*b*). The standard of purity shall be the same as that required by the United States Public Health Service and promulgated by the Treasury Department.

285 (*c*). It shall be unlawful for any person to remove, cover up, take down, or otherwise destroy the sign or other notice placed by any board of health, health officer, or duly authorized representative of said board, warning the public "Do not drink this water."

[GARBAGE, REFUSE, AND DEAD ANIMALS. REG. BD. OF H., APR. 11, 1916.]

The following section has been inserted after section 477 of chapter 21 of the Sanitary Code of Louisiana:

SEC. 477–A. (*a*) No house refuse, offal, garbage, dead animal, decaying vegetable matter, or organic wastes of any kind shall be thrown upon any street or road.

(*b*) No garbage dump or place of deposit shall be maintained at any point in the State unless provision be made for prompt destruction of material deposited. Destruction shall be by incineration or other effective means to prevent the breeding of flies, harboring of rats, or the creating of a nuisance.

(*c*) No such refuse, putrescible, decaying animal or vegetable matter shall be kept in any house, cellar, outhouse, or on premises for more than 48 hours in any incorporated or unincorporated village, town, or city or built-up community.

(*d*) No person shall throw or deposit any garbage, offal, night soil, dead carcasses of animals, or filth into or where same would drain into any public or private well, cistern, or other water supply.

(*e*) All receptacles for temporary storage for handling of garbage, etc., shall be water-tight and be provided with suitable tight-fitting covers, which shall be kept properly adjusted to the receptacles so that flies or insects, rats, or other animals may not have access to contents.

(*f*) All garbage or refuse containers shall be emptied at least once every 48 hours, and containers cleaned and aired before being replaced for service.

(*g*) No garbage or waste destruction plant shall be built, nor any place of disposal maintained, unless approved by the local or State board of health.

MAINE.

[REVISED STATUTES, 1903, CHAP. 18.]

8. *Regulations of State board of health* (as amended by Public Laws, 1915, chapter 338).—* * * And the said board of health may from time to time, make, alter, modify, or revoke rules and regulations for guarding against the introduction of any infectious or contagious diseases into the State, including rabies, or hydrophobia of animals and men; for the control and suppression thereof if within the State; for the quarantine and disinfection of persons, localities and things infected or suspected of being infected by such diseases; for guarding against the transmission of infectious and contagious diseases through the medium of common towels, common drinking cups, and other articles which may carry infection from person to person; * * *.

65. *Depositing carcass of dead animal where it may cause nuisance.*—Whoever personally or through the agency of another leaves or deposits the carcass of a dead horse, cow, sheep, hog, or of any other of the larger domestic animals in any place where it may cause a nuisance shall, upon receiving a notice to that effect from the local board of health, promptly remove, bury or otherwise dispose of such carcass, and if he fails to do so within such time as may be prescribed by the local board of health, and in such manner as may be satisfactory to such board of health, he shall be punished by a fine of not less than $5 nor more than $25 or by imprisonment not exceeding one month.

[REVISED STATUTES, 1903, CHAP. 20.]

8 (as amended by acts of 1907, chapter 60). *Location of cemeteries near wells.*—* * * Nor shall any person, corporation, or association establish, locate, or enlarge any cemetery or burying ground, by selling or otherwise disposing of land, so that the limits thereof shall be extended nearer any dwelling house or well within 25 rods, against the written protest of the owner: *Provided,* That nothing in this section shall prohibit the sale or disposition of lots within the limits of any existing cemetery or burying ground, nor the extension thereof away from any dwelling house or well.

[REVISED STATUTES, 1903, CHAP. 22.]

5. *Nuisances.*— * * * corrupting or rendering unwholesome or impure the water of a river, stream, or pond * * * are nuisances * * *.

11. *Water mills and dams may not be nuisances.*—The erection and maintenance of water mills and dams to raise water for working them upon or across streams not navigable, as provided in chapter 94 [of Revised Statutes, 1903], shall not be deemed a nuisance unless they become offensive to the neighbor-

hood or injurious to the public health, or unless they occasion injuries or annoyances of a kind not authorized by said chapter. * * *

12. *Penalty.*—Whoever erects, causes, or continues a public or common nuisance, as herein described or at common law, where no other punishment is specially provided, may be fined not exceeding $100; and the court, with or without such fine, may order such nuisance to be discontinued or abated, and issue a warrant therefor, as hereinafter provided. (Secs. 14–17, giving process of abatement of nuisance, are not given in this appendix.)

13. *Action for damages.*—Any person injured in his comfort, property, or the enjoyment of his estate by a common and public or a private nuisance may maintain against the offender an action on the case for his damages, unless otherwise specially provided.

[REVISED STATUTES, 1908, CHAP. 94.]

1. *Right to erect mill dams.*—Any man may, on his own land, erect and maintain a water mill and dams to raise water for working it, upon and across any stream not navigable; or, for the purpose of propelling mills or machinery, may cut a canal and erect walls and embankments upon his own land, not exceeding 1 mile in length, and thereby divert from its natural channel the water of any stream not navigable, upon the terms and conditions and subject to the regulations hereinafter expressed. (Only the regulations affecting the question of pollution of the water will be cited.)

2. *Where dam injures another mill or canal.*—No such dam shall be erected or canal constructed to the injury of any mill or canal lawfully existing on the same stream * * *.

34. *Owner liable for pollution by wastes from his mill.*—The owner or mortgagee in possession, as well as any tenant, of any mill used for manufacturing lumber, is liable for the acts of such tenant in unlawfully obstructing or diverting the water of any river or stream, by the slabs or other mill waste from his mill, but no action shall be maintained therefor without a demand of damages, at least 30 days prior to its commencement. Such unlawful obstruction or diversion by the tenant shall, at the election of the owner or mortgagee and on written notice to the tenant, terminate his tenancy.

[REVISED STATUTES, 1908, CHAP. 128.]

5. *Penalty for willful injury to ice.*—Whoever willfully and wantonly or maliciously cuts, injures, mars, or otherwise destroys or damages ice upon any waters from which ice is or may be taken as an article of merchandise, whereby the taking thereof is hindered or the value of the same is diminished for that purpose; or whoever willfully and wantonly or maliciously incites or procures another to do so, shall be punished by fine not exceeding $500 or by imprisonment not exceeding one year; and it is not necessary to allege or prove the title or ownership of the ice so cut, injured, marred, damaged, or destroyed.

[REVISED STATUTES, 1908, CHAP. 129.]

1 (as amended by Acts of 1917, Chap. 126).[1] *Prohibiting poisoning water supplies.*—Whoever knowingly and willfully poisons, defiles, or in any way corrupts the waters of any well, spring, brook, lake, pond, river, or reservoir, used for domestic purposes for man or beast, or knowingly corrupts the sources of

[1] Amending law reads "Section 1 of Chap. 130 of the Revised Statutes is hereby amended, etc." Section amended is in Chap. 129.

any public water supply, or the tributaries of said sources of supply in such manner as to affect the purity of the water so supplied, or knowingly defiles such water in any manner, whether the same be frozen or not, or puts the carcass of any dead animal or other offensive material into said waters, or upon the ice thereof, shall be punished by a fine not exceeding $5,000 or by imprisonment for any term of years.

[ACTS OF 1905, CHAP. 77.]

SEC. 1. *Dead fish not to be cast into rivers.*—It shall be unlawful to cast or deposit upon the shores, or release and deposit in the bays, harbors, or rivers of this State any dead fish or fish that have been smothered or injured so that they will die.

SEC. 2. *Penalty.*—All persons willfully violating the provisions of this act, or aiding therein, shall be liable to a penalty of $100, or imprisonment[1] not exceeding 30 days, or both, as the court before which the complaint or indictment for the violation of the preceding section may be instituted shall determine.

SEC. 3 (as amended by acts of 1909, chap. 56). *How penalty is to be recovered—Disposal of fines.*—The penalty provided for by the preceding section may be recovered in the county where the offense is committed by complaint, indictment, or action of debt brought in the name of the person making the complaint; and all fines and penalties recovered by this act shall go, one half to the person making the complaint and the other half to the commissioner of sea and shore fisheries, and by said commissioner of sea and shore fisheries paid to the State treasurer to be added to and made a part of the appropriation for sea and shore fisheries.

[ACTS OF 1913, CHAP. 206.]

SEC. 13. *Putting meat, dead fish, etc., in inland waters prohibited.*—Whoever deposits any meat, bones, dead fish, or parts of the same, or other food for fish, in any of the inland waters of the State, for the purpose of luring fish, known as "advance baiting," shall pay a fine of not less than $10 nor more than $30 and costs of prosecution for each offense.

SEC. 14. *Prohibiting putting into certain streams any lumber-mill waste.*—No person or corporation shall place or deposit in any of the lakes or ponds of the State, or into any of the following named rivers, brooks, and streams, to wit[2] * * * * or allow the same to be done by anyone in their employ, any slabs, edgings, sawdust, chips, bark, mill waste, shavings, or fibrous material created in the manufacture of lumber, or place or deposit the same on the banks of any of the above-named waters in such negligent or careless manner that the same shall fall or be washed into the same, or with the intent that the same shall fall or be washed into the same.

Whoever violates any of the provisions of this section shall pay a fine of not less than $5 and not exceeding $100 and cost for each offense.

[PUBLIC LAWS, 1917, CHAP. 98.]

SECTION 1. *Public utilities commission to consult with cities and towns as to water supply, etc.*—The public utilities commission shall consult with and advise the authorities of cities and towns and persons and corporations having, or about to have, systems of water supply, drainage, or sewage, as to the most appropriate source of water supply and the best method of assuring its purity

[1] Law reads "or by imprisonment."
[2] It appears unnecessary to name the streams.

or as to the best method of disposing of their drainage or sewage with reference to the existing and future needs of other cities, towns, or persons or corporations which may be affected thereby. It shall also consult with and advise persons or corporations engaged or intending to engage in any manufacturing or other business whose drainage or sewage may tend to pollute any inland water, as to the best method of preventing such pollution, and it may conduct experiments to determine the best method of the purification or disposal of drainage or sewage. No person shall be required to bear the expense of such consultation, advice, or experiment. Cities, towns, persons, and corporations shall submit to said commission for its advice their proposed system of water supply or of the disposal of drainage or sewage and all petitions to the legislature for authority to introduce a system of water supply, drainage, or sewage shall be accompanied by a copy of the recommendation and advice of said commission thereon. In this section the term "drainage" means rainfall, surface, and subsoil water only, and "sewage" means domestic and manufacturing filth and refuse.

SEC. 2. *Commission to investigate pollution of streams on request of mayor, etc.*—Upon petition to said commission by the mayor of a city or the selectmen of a town the managing board or officer of any public institution, or by a board of water commissioners, or the president or other official of a water or ice company, stating that manure, excrement, garbage, sewage, or any other matter pollutes or tends to pollute the waters of any stream, pond, spring, or watercourse used by such city, town, institution, or company, as a source of water supply, the commission shall appoint a time and place within the county where the nuisance or pollution is alleged to exist for a hearing, and after such notice thereof to parties interested and a hearing, if in its judgment the public health so requires, may, by an order served upon the party causing or permitting such pollution, prohibit the deposit, keeping, or discharge of any such cause of pollution, and shall order him to desist therefrom and to remove any such cause of pollution; but the commission shall not prohibit the cultivation and use of the soil in the ordinary methods of agriculture if no human excrement is used thereon. Said commission shall not prohibit the use of any structure which was in existence on or before the first day of January, 1917, upon a complaint made by any city, town, corporation, or water district, water or ice company, unless such city, town, corporation, water district, or company files with said commission a vote of its city council, selectmen, corporation, water district, or company that such city, town, corporation, water district, or company will, at its own expense, make such changes in said structure or its location as said commission shall deem expedient. Such vote shall be binding on such city, town, corporation, water district, or company, and all damages caused by any such change shall be paid by such city, town, corporation, water district, or company. If the parties can not agree thereon the damage shall, on petition of either party, filed within one year after such changes are made, be assessed by a jury in the supreme judicial court for the county where such structure is located.

SEC. 3. *Appeal from order passed under provisions of section 2.*—Whoever is aggrieved by an order passed under the provisions of the preceding section may appeal therefrom to the supreme judicial court sitting in the county where appellant resides; but such notice of the pendency of the appeal as the court shall order shall also be given to the board of water commissioners and the mayor of the city or chairman of the selectmen of the town or president or other officer of the water or ice company interested in such order. While the appeal is pending the order of the commission shall be complied with unless otherwise authorized by the commission.

SEC. 4. *Supreme judicial court to restrain pollution pending carrying out of orders of commission.*—The supreme judicial court shall have jurisdiction in equity, upon the application of the public utilities commission or of any party interested, to enforce its orders, or the orders, rules, and regulations of said public utilities commission, and to restrain the use or occupation of the premises or such portion thereof as said commission may specify, on which said material is deposited or kept, or such other cause of pollution exists, until the orders, rules, and regulations of said commission have been complied with.

SEC. 5. *Agents of commission may enter premises.*—The agents and servants of said public utilities commission may enter any building, structure, or premises for the purpose of ascertaining whether sources of pollution or danger to the water supply there exists and whether the rules, regulations, and orders aforesaid are obeyed.

SEC. 6. *Pollution of streams prohibited.*—Unless the public utilities commission determines that public health will not thereby be seriously injured no sewage, drainage, refuse, or polluting matter of such kind and amount as either by itself or in connection with other matter will corrupt or impair the quality of the water of any pond or stream used as a source of ice or water supply by a city, town, public institution, or water company for domestic use or render it injurious to health, and no human excrement shall be discharged into any such pond or stream or upon the banks thereof if any filtering basin in use is there situated. The prohibition against the deposit of sewage, drainage, refuse, polluting matter, and human excrement shall not apply to the following rivers, namely, the Penobscot, the Kennebec, the Androscoggin, and the Saco.

SEC. 7. *Penalty.*—Whoever violates any rule, regulation, or order made under the provisions of any section hereof shall be punished for each offense by a fine of not more than $500 to the use of the State or by imprisonment for not more than one year, or by both such fine and imprisonment.

SEC. 8. *Appropriation.*—Said commission may appoint, employ, and fix the compensation of such agents, clerks, servants, engineers, and expert assistants, as is considered by said commission necessary, and for the purpose of carrying out the provisions of this act, said commission may expend the sum of not over $4,000 in each of the years 1917 and 1918, which sums are hereby appropriated therefor.

[ACTS OF 1917, CHAP. 197.]

SECTION 1. *Department of health created.*—There is hereby created a State department of health which shall exercise all the powers and perform all the duties now conferred and imposed by law upon the State board of health. * * *

[ACTS OF 1917, CHAP. 219.]

SECTION 24. *Use of poisonous substance for destroying fish.*—Whoever * * * shall use any * * * poisonous or stupefying substance for the purpose of destroying or taking fish * * * shall pay a fine of not less than $10 nor more than $80, and costs of prosecution, for each offense; and in addition thereto $1 for each fish taken, caught, killed, or had in possession in violation of any provision of this section; and when prohibited implements or devices are found in use or possession, they are forfeit and contraband, and any person finding them in use may destroy them.

MARYLAND.

[ANNOTATED CODE, 1914,[1] ARTICLE 27.]

86. *Polluting of ice or ice ponds.*—Any person who shall enter upon the land or premises of any other person, whether such other person be the owner or lessee of said property or premises, and willfully and maliciously injure any ice upon any pond or stream of water upon said land so as to injuriously affect the quality of the same as an article for sale or use, or who shall from beyond the property or premises of any such owner or lessee willfully and maliciously thereon cast or discharge upon any such ice any substance whatever which shall so injure the same, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined not less than $10 nor more than $20, or imprisoned for 30 days, in the discretion of the court; and the ownership in said ice may be laid in the indictment to be either in any of the persons who have at the time of the commission of said act the right to gather said ice for use or sale as owner or lessee of said land on which said pond or stream may be situated, or in any other person who has the legal right to gather the said ice for sale or use by license from or contract with such owner or lessee.

409A (added by Laws, 1917, Chap. 8). *Poisoning of wells, etc., prohibited.*—Every person, his aiders and abettors, who knowingly and willfully poisons, defiles, or in any way corrupts or contaminates the waters of any well, spring, brook, lake, pond, stream, river, reservoir, or other source of water supply, or any tributary thereof, used or usable for drinking or domestic purposes, by means of disease germs or bacteria or the insertion of any other poison or poisonous matter therein, or attempts so to do, or conspires or connives thereat, and every person, his aiders and abettors, who, by like means, knowingly and willfully poisons, defiles, or in any way corrupts or contaminates any drink, food or food products, or supply, or attempts so to do, or conspires or connives thereat, shall be guilty of a felony, and upon conviction thereof shall be subject to imprisonment in the penitentiary for not more than 20 years, in the discretion of the court.

429. *Prohibiting dumping in Chesapeake Bay above Sandy Point and its tributaries.*—If any ballast, ashes, filth, earth, soil, oysters, or oyster shells be taken, unladen, or cast out of any ship, steamboat, scow, pungy, or other vessel on any pretense whatever in Chesapeake Bay above Sandy Point or in the waters of Herring Bay or in any river, creek, or harbor within the State below high-water mark, the master or other person having charge or command of such ship, steamboat, scow, or other vessel shall, upon conviction thereof before any justice of the peace of this State, be fined not less than $20 nor more than $150, one half of which amount shall be paid to the informer and the other half to the State; but anyone convicted of violating the provisions of this section shall be entitled to appeal to the circuit court for the county in which he was convicted, or to the Baltimore City court, if the offense was committed in the city of Baltimore. This section shall not, however, be construed to apply to the improvement of harbors or to affect any existing act of assembly relating to the construction of wharves or to the rights of riparian proprietors.

430. *By whom enforced.*—The commanding officer of the State fishery force is required and directed to enforce the provisions of the preceding section.

[1] Two volumes, giving all of code to 1910 except article 27 ("Crimes and punishments") were published in 1910. A third volume, published four years later, gave article 27 and the additions and amendments to the code, including this article, down to 1914.

481. *Prohibiting placing of carcasses in certain waters.*—If any person shall place, cast, or throw into the Potomac River at any point above the canal dam, near the mouth of Wills Creek, any dead body or carcass of any dog, horse, cow, hog, cat, or other animal whatsoever, or shall drown therein any animal whatsoever, or shall place, cast, or throw therein any substance whatsoever calculated to render the waters of said river impure or unfit for use, he shall forfeit and pay a sum of not less than $20 nor more than $100, one half to the informer and the other half to the State, to be recovered by action of debt or indictment in the county wherein the offense was committed.

482. *Water supply—Pollution of sources of.*—If any person shall put, or cause to be placed, any dead animal, or part of the carcass of any dead animal, or any decayed or filthy animal or vegetable matter into any stream, or the tributary of any stream, well, spring, reservoir, pond, or other source from which water or ice is drawn, taken or used for drinking or domestic purposes, or shall knowingly suffer any sewage, washings, or other offensive matters from any privy, cesspool, factory, trades establishment, slaughterhouse, tannery, or other place, over which he shall have control, to flow therein, or into any drain or pipe communicating therewith, whereby the water supply of any city, town, village, community, or household is fouled or rendered unfit for drinking and domestic purposes, he shall be guilty of a misdemeanor, and shall, upon conviction thereof in a court of competent jurisdiction, be fined not more than $200 for every such offense; and after reasonable notice, not exceeding 15 days, from the State board of health, or any local sanitary authority, to discontinue the act whereby such water supply is fouled, a further sum of not more than $50 for every day during which the offense is continued.

[ANNOTATED CODE, 1914, ARTICLE 89.]

74. *Poisoning fish.*—No person shall place in any fresh-water stream, lake, or pond, without the consent of the owner, or in the waters and estuaries with the rivers debouching into them, any lime or other deleterious substance, with the intent thereby to poison or catch fish, under a penalty of $100.

82. *Trade wastes deleterious to fish.*—No person shall place, throw, or make use of in any of said waters [any stream above where the tide ebbs and flows], except from bona fide engineering, milling, or mining purposes, * * * any lime, poison, acid, sawdust, shaving, or other substance whatsoever deleterious to or destructive of fish life, under a penalty of not less than $100 nor more than $800, or imprisonment in the penitentiary for not less than one year nor more than three years, or be both fined and imprisoned in the discretion of the court: *Provided, however*, That nothing in this section shall apply to sawmills now in operation until October 1, 1903, unless said sawmill or mills shall in the meantime change its or their location: *And further provided*, That any sawmill or mills moving from its or their present location, shall be considered a new mill or mills, and shall be subject to the provisions of this section.

82A (added by Laws, 1917, Chap. 14). *Pollution to be investigated by conservation commission, etc.*—Whenever any watercourse, well, spring, open ditch, gutter, cesspool, sewer, private or public, drain, privy-pit, pigpen, or other place, or any accumulation or deposit of waste or other offensive or noxious matters discharged from any house, building, trades establishment or manufacturing place or any waste from any vessel, shall become or dangerously threaten to become deleterious to or destructive of fish or shellfish life, or the propagation, cultivation, or conservation thereof, or to their safety as human food, or in any manner a menace to said fish or shellfish, whether private or public prop-

erty, in any waters of the State, the conservation commission of Maryland shall forthwith investigate the matter, and, if it be so found, shall serve a notice in writing on the person, firm, or corporation by whose act, default, or sufferance such condition may arise or continue, requiring the abatement of the same within a time to be fixed by the commission and to be specified in the notice, under a penalty of not less than $100 nor more than $300, or imprisonment for not less than one year nor more than three years, or be both fined and imprisoned, in the discretion of the court. It shall be construed as a separate and distinct offense for each day the nuisance is permitted to continue after the expiration of the time limit set forth in the notice for the abatement of such nuisance: *Provided, however*, That nothing herein contained shall be deemed to alter, change, modify, or restrict the jurisdiction of the State board of health of Maryland: *Provided, however*, That the provisions of this section shall not apply to the sewerage [sic] disposal plant of any city, town, or county in this State.

[ANNOTATED CODE, 1914, ARTICLE 43.]

2 (as amended by Laws of 1914, chapter 675). *Regulations of State board of health.*—The State board of health * * * shall have the power * * * to make rules and regulations not inconsistent with law regulating the character and location of plumbing, drainage, water supply, disposal of sewage, garbage, or other waste material, and offensive trades; the sanitary condition of streets, alleys, outhouses, cesspools, and all sanitary features connected therewith; no rule or regulation, however, to carry a higher penalty than $100 for each offense, and all such rules and regulations to bear the seal of the State board of health and be attested by its secretary and be published not less than three times in some daily newspaper published in the city of Baltimore, such rules and regulations not to be effective until 30 days after their publication.

28. *Bureau of sanitary engineering to investigate pollution of water supplies.*—The bureau of sanitary engineering [of the State board of health] shall examine into all public and private system [sic] of water supply and prepare proper maps and drawings of the same for permanent record; it shall examine and patrol as far as possible the watersheds or catchment basins of all public water systems and investigate and report upon all sources of pollution of public and private water supplies; it shall investigate and report upon all private and public systems of sewage disposal; it shall inquire into and investigate the water supply, sewage disposal * * * of schools, asylums, jails, and other public institutions; it shall inquire into and investigate offensive trades and nuisances, disposal of trades wastes, sewage and other offensive matters, and devise means for their control and perform such other duties and exercise such other functions as the State board of health or the secretary thereof shall designate.

108. *Nuisances.*—Whenever any watercourse, well, spring, open ditch, gutter, cesspool, drain, privy pit, pigpen, or other place, or any accumulation or deposit of offensive or noxious matters, or any house, building, trades' establishment, or manufacturing place is certified to the State board of health by any two legally qualified medical practitioners, or any three or more persons affected thereby, to be in a state of nuisance dangerous to health, the said board of health shall forthwith investigate the matter, and if it shall be found that the nuisance complained of is such as to injuriously affect any adjacent property or district, or is calculated to endanger the health or life of any person, the said board shall, through its proper officer, serve a notice in writing on the person, firm, or corporation by whose act, default, or sufferance the nuisance arises or continues;

or if such person, firm, or corporation can not be found, or [on] the owner or occupier of the premises on which the nuisance arises or exists, requiring him or them to abate the same within a time to be specified in the notice, and to execute such works and do such things as may be necessary for that purpose. (Details of process of abatement of nuisance, secs. 104–6, are omitted.)

269.[1] *Waters, ice, and sewerage.*—The term "waters of the State" shall include that portion of the Atlantic Ocean and its estuaries within the State of Maryland, the Chesapeake Bay and its estuaries, and all springs, ponds, streams, wells, and bodies of surface or ground water, whether natural or artificial, within the boundaries of this State or subject to its jurisdiction. "Sewage" shall mean human and animal excretions, street wash, and all domestic and manufacturing waste. "Waterworks," "water supply," and "water-supply system" shall mean the sources and their surroundings from which water is supplied for drinking or domestic purposes, together with all structures, channels, and appurtenances by means of which it is prepared for use and delivered to consumers; excepting only the piping and fixtures inside the buildings served. "Sewerage system" shall mean the channels by which sewage is collected and disposed of, together with the body of water into which it is directly discharged, and all structures and appurtenances made use of in its collection and preparation for discharge in satisfactory condition into the waters of the State; excepting only the plumbing system inside the individual buildings served. For the purposes of this subtitle any sewer, no matter what its length and size may be, shall be sufficient to constitute a sewerage system.

270. *State board of health to have control over the waters of the State.*—The State board of health shall have general supervision and control over the waters of the State, in so far as their sanitary and physical condition affects the public health or comfort; and it may make and enforce rules and regulations, and order works to be executed to correct and prevent their pollution. It shall investigate all sources of water and ice supply, and all points of sewage discharge. It shall examine all existing public water supplies, sewerage systems, and refuse-disposal plants, and shall have power to compel their operation in a manner which shall protect the public health and comfort, or to order their alteration, extension, or replacement by other structures when deemed necessary. After April 16, 1914, it shall pass upon the design and construction of all public water supplies, sewerage systems, and refuse-disposal plants which shall be built within the State.

271. *State board of health to advise with counties and municipalities.*—The State board of health shall, when requested, consult with and advise the authorities of counties, municipalities, and persons having, or about to have, systems of water supply, drainage, sewerage, or refuse disposal, as to the most appropriate source of water supply, and the best method of assuring its purity, or as to the best method of disposing of drainage, sewage, or refuse with reference to the existing and future needs of all communities or persons which may be affected thereby. It shall also consult with and advise corporations, companies, and individuals engaged, or intending to engage, in any manufacturing or other business whose sewage may tend to pollute the waters of the State. It may also conduct experiments relating to the purification of water and the treatment of sewage or refuse. No county, municipality, corporation, company, or individual shall be required to bear the expense of such consultation, advice, or experiments. Information that may be given shall be only of such preliminary nature as to outline the best course to pursue, and in no case shall the State board of health be required to prepare plans,

[1] Secs. 269–288 are secs. 1–20 of Chap. 810, Acts of 1914.

specifications, or detailed estimates for any improvement unless it be specifically delegated to do so by the governor or legislature and adequate special appropriations be provided for the purpose.

272. *Plans for water or sewerage systems to be filed with State board of health.*—Every county, water, sewerage or sanitary district authority, municipality, corporation, company, institution, and individual supplying or authorized to supply, on April 16, 1914, water, sewerage, or refuse disposal service to the public, or owning water or sewerage systems, or refuse disposal plants, serving or authorized to serve the public, within the State, shall, within six months after said date, file with the State board of health a certified copy of the plans of its water supply or sewerage system, or refuse disposal plant, complete; such plans to be correct to date of submission, and to be of such scope and in such detail as to be satisfactory to the State board of health. In case no plans, or only those of insufficient scope or detail, are in existence, this section shall be complied with by the preparation of new, or the completion of the existing plans, and such investigations as may be necessary to insure the approximate correctness of the plans shall be instituted by the county, district authority, municipality, corporation, company, institution, or individual required to supply them. In case specifications of or reports on the water supply and sewerage systems or refuse disposal plants are in existence, they shall be submitted, as well as plans. The State board of health may request such other information and records concerning the water supply and sewerage systems or refuse-disposal plants, and their maintenance and operation, as it may deem proper for its purposes; and it shall be the duty of the county, district authority, municipality, corporation, company, institution, or individual interrogated to furnish such information and records.

273. *State board of health to issue orders to improve unsatisfactory systems.*—When the State board of health finds, upon investigation, that any water supply or sewerage system, or refuse-disposal works, on account of incompetent supervision or inefficient operation, is not producing such results, from a sanitary standpoint, as might reasonably be expected, or is in any way a menace to health or comfort or is creating a nuisance, it shall issue an order to the proper officer, board, department, or person having charge of or owning such system or plant, to secure such operating results as might be reasonably expected, which results shall be, and shall be produced within such time as shall be satisfactory to the State board of health. If the desired results be not produced within the time specified, the State board of health may order the proper officer, board, department, or person having charge of or owning such system, or plant, to appoint, within such time as it may specify, and pay the salary of, a competent person, to be approved by the State board of health, who shall take charge of and operate such system or plant, so as to secure the results demanded by the board.

274. *State board of health may require alterations, extension, etc., of unsatisfactory systems.*—When the State board of health finds, upon investigation, that any water supply or sewerage system, or refuse-disposal works, is in any way a menace to health or comfort, or is creating a nuisance, and conditions can not be sufficiently improved, in the opinion of the board, by mere change in the method of operation, the State board of health shall be empowered to issue an order requiring the owner of the system or plant to make such alterations or extensions to the system or plant, or to install such new system or plant, as the board may determine necessary to correct improper conditions. The State board of health shall name in its order such date for the completion of the work as it may deem reasonable and proper.

275. *State board of health may require installation of new systems where water is polluted.*—When the State board of health finds, upon investigation, that any of the waters of the State are being, or are liable to become, polluted in a way dangerous to health, or so as to be in any way a nuisance, and such condition is due to the fact that there is no or only a partial system of public water supply, sewerage, or refuse disposal in a certain county, municipality, district, subdivision, or locality; or in case absence or incompleteness of a public system of water supply, sewerage, or refuse disposal in any county, municipality, district, subdivision, or locality is, in the opinion of the State board of health, sufficiently prejudicial to the health or comfort of that or any other county, municipality, district, subdivision, or locality, then the State board of health, may issue an order to the effect that a public system of water supply, sewerage, or refuse disposal shall be installed and put into operation, or the existing system completed in that county, municipality, district, subdivision, or locality within a specified time; or the board may order the installation of such devices or the institution of such methods and enforce such measures or regulations as it may deem proper under the circumstances.

276. *Permits required for construction or alteration of water or sewerage systems.*—After April 16, 1914, the State, a county, municipality, district, corporation, company, institution, or person shall not install a system of water supply, sewerage, or refuse disposal for public use, nor materially alter or extend any such existing system without having received a written permit from the State board of health so to do; nor shall any permit for this purpose be issued until complete plans and specifications for the installation, alteration, or extension, together with such information as the State board of health may require, have been submitted and approved by the board. All construction shall take place in accordance with the approved plans. In case it shall become necessary or desirable to make material changes in plans or specifications, together with a statement of the reasons for the alteration, shall be submitted to the State board of health, and no material changes shall be embodied in the actual construction until they are approved by the board and a permit issued therefor. After completion of the work a certified copy of the plans in full, showing the work as built, shall be filed with the State board of health for permanent record. The State board of health shall be empowered to make and enforce such rules and regulations regarding the submission of plans for approval and record as it may deem reasonable and proper. Before plans are drawn or application filed for a prospective system of water supply, sewerage, or refuse disposal, a preliminary statement concerning the improvement may be made to the State board of health, whereupon the State board of health shall, if requested, outline the general requirements of the case conformity with which would meet with the board's approval. Whenever application shall be made to the State board of health for a permit under the provisions of this section, it shall be the duty of the board to examine the application without delay, and, as soon as possible thereafter, to issue said permit, disapprove the application, or state the conditions under which said permit will be granted.

278. *Plans for water and sewerage systems required before subdivided land is placed on market.*—Before land platted for subdivision is put upon the market by any corporation, company, persons, or person, and before any permanent building is erected thereon, there shall be filed with the State board of health a plat of such subdivision, together with a statement as to the methods proposed for supplying the subdivision with water and sewerage service, and such other information as may be required by the board. The State board of health may thereupon order the preparation and submission of such plans and specifica-

tions, within a specified time, as it may deem necessary for furnishing adequate water supply and sewerage service to said subdivision; and it may at any time order the installation, within a specified period in accordance with the plans presented or approved revisions thereof, of the whole or any part of the water supply and sewerage systems for said subdivision as the public health may, in its judgment, require.

279. *State board of health to prevent pollution from industrial wastes.*—Whenever the State board of health shall find that any of the waters of the State are polluted by wastes from any manufacturing or industrial establishment, in such a way as to be or to be liable to become a menace to the public health or comfort, or whenever the existing method of waste disposal in a manufacturing or industrial establishment is found to be or be liable to become in any way a menace to health or comfort, the State board of health shall issue an order requiring the owner of such establishment to cease pollution of the body of water into which the waste is discharged, or to make such alterations in the method of disposing of said waste, as the board may deem necessary to protect the public health and comfort; and said order shall be complied with within such time as the State board of health shall determine. Plans for all such changes in the method of disposing of trades wastes shall be submitted to the State board of health for approval, and all construction shall be carried out in conformity therewith. If the State board of health shall approve the plans submitted, it shall issue a permit for the use of the method proposed for taking care of the waste, and no revised method for taking care of said waste shall be put into effect without such permit. The owner of any manufacturing or industrial establishment shall submit to the State board of health, on demand, all plans, information, and records regarding the existing methods used for the disposal of wastes at that establishment.

280. *Condemning sources of water or ice supplies.*—Whenever the State board of health shall find that the water or ice from any public or private source of water or ice supply is or is likely to become dangerous to health, or that the discharge of sewage or the method of disposal of sewage or refuse from any system or plant, public or private, is, or is likely to become, prejudicial to health or comfort, it shall order that said source of water or ice supply shall be closed, or said point of sewage discharge, or method of disposal of sewage or refuse, abandoned; or the board may order that such works or devices shall be installed, or such measures instituted, as shall be sufficient to remedy existing conditions, if in its judgment such conditions can be remedied in a practical manner by said works, devices, or measures. In case a public or private system of water supply, sewerage, or refuse disposal is condemned by the State board of health, the board may order such arrangements made by the owner of said system or plant as will effectually prevent its operation. The State board of health shall specify such date for compliance with any order provided for in this section as it may deem reasonable and proper.

281. *State board of health may order the abandonment of privies, etc.*—Whenever a system of water supply or sewerage, serving the public, is directly available to any property upon which there exists a spring, well, cesspool, privy, sink drain, or private sewage-disposal plant, which is, or may become, prejudicial to health, the State board of health may order said property to be connected with the water supply or sewerage system, and the spring, well, cesspool, privy, sink drain, or private sewage-disposal plant abandoned and left in such a way that it can not be again used nor become injurious to health. The State board of health shall be empowered to prevent the construction of any proposed well, cesspool, privy, sink drain, or private sewage-disposal plant

whenever or wherever it may deem that the proposed construction would be prejudicial to health. After April 16, 1914, no privy shall be built within the State of Maryland, except it be of such construction as will effectually prevent any contact of fecal matter with the soil and also access to such matter by flies. The State board of health shall be the judge as to whether or not any privy is built in conformity with this rule, and if it shall find that the regulation has not been strictly complied with, it shall condemn the structure and shall order that such changes be made as will be sufficient for compliance with this provision.

282. *State board of health to have control over sources of potable waters to be sold in containers.*—The State board of health shall have supervision and control over the surroundings of any source from which either surface or underground water, for potable purposes, is collected for delivery in containers; and it shall also assume jurisdiction over the method of collecting, bottling, and delivering such waters. After April 16, 1914, no such waters shall be collected, bottled, or delivered until a written permit so to do has been issued by the State board of health to the owner of such supply. No such permit will be issued if the State board of health determines that said water is in any way injurious to the public health. Corporations, companies, and persons handling potable waters shipped from points outside of the State of Maryland, shall receive permits to sell waters only upon presentation to the State board of health of a permit, issued by the State board of health of the State from which the water is collected, stating that the source of such water supply and the method of handling the water, as practiced within the limits of that State, are such as not to be prejudicial to the public health, and that said water is allowed to be sold within the limits of the State issuing said permit. Nothing herein provided shall, however, prevent the State board of health from prohibiting the use of such water shipped from another State if, in its judgment, said water is shown by analysis to be unfit for potable purposes or if its quality in any way is injured by such handling as may be accorded to it after arriving within this State.

283. *Permit required for new sources of ice supplies, etc.*—After April 16, 1914, no new source of ice supply, either natural or artificial, shall be used for furnishing ice to the public for domestic purposes unless such source be approved by the State board of health and a written permit issued by the board for the harvesting or manufacture and the sale of ice from said source. No ice shall be stored in an unclean place, handled in an unclean manner, nor brought into contact with polluted water. The State board of health shall be empowered to make and enforce such rules and regulations as it may deem proper regarding the selection and care of sources of ice supply and the methods employed in harvesting, manufacturing, storing, and handling ice.

284. *Records to be kept by local health authorities.*—All such records as may be required by the State board of health shall be kept by counties, municipalities, districts, corporations, companies, and persons supplying water, ice, sewerage, or refuse-disposal service to the public; by corporations, companies, and persons owning manufacturing and industrial establishments; and by owners of private systems of water supply and sewerage; and the State board of health shall be supplied at all times with all records and information, upon demand. Agents of the State board of health shall be allowed entry to all buildings, structures, and premises owned by counties, municipalities, districts, corporations, companies, and persons supplying the public with water, ice, sewerage, or refuse-disposal service, or upon all private properties, for the purpose of collecting samples, records, and information and ascertaining

whether the rules, regulations, and orders of the State board of health are obeyed.

285. *Permits revocable by State board of health, etc.*—Every permit issued by the State board of health under this subtitle shall be revocable or subject to modification and change by the State board of health, after due notice of which contemplated action has been given by the board to the recipient of such permit. When the length of time that a permit is to run is specified in such permit, said permit shall become automatically inoperative at the expiration of the period of time prescribed, without notice to that effect having been given by the State board of health.

286. *Appeal from State board of health's decisions.*—Any county, municipality, legally constituted water, sewerage, or sanitary district, corporation, company, institution, or person dissatisfied with any order or regulation of the State board of health under the provisions of this subtitle, may commence, within 10 days after the service of such order or regulation, any action in the circuit court for any county or before any judge of the supreme bench of Baltimore city, in any court of Baltimore city of appropriate jurisdiction against the State board of health as defendant, to vacate and set aside any such order or regulation on the ground that such order or regulation is unlawful or unreasonable, or that said order is not necessary for the protection of the public health or comfort, in which action a copy of the complaint shall be served with the summons. The answer of the State board of health shall be filed within 10 days, whereupon said cause shall be at issue and stand ready for trial upon 15 days' notice to either party. All such actions shall have precedence over any civil cause of a different nature, except appeals from an order of the public-service commission, and the said courts shall always be deemed open for trial thereof, and the same shall be tried and determined as other civil actions. Either party to said action, within 20 days after service of a copy of the order or judgment of any court of Baltimore city or of the circuit court of any county, may appeal to the Court of Appeals of Maryland.

287. *Penalty for noncompliance with State board of health orders.*—If any county, municipality, water, sewerage, or sanitary district, corporation, company, or institutition, or officer thereof upon whom the duty to act is cast, or any person shall fail to comply with any order of the State board of health before the expiration of the time specified for compliance with said order, or in case of appeal or appeals, for a period of 10 days after final judgment affirming the board's order shall have been entered, to obey said order or in good faith to begin to obey the same; such county, municipality, district, corporation, company, or institution, or officer thereof, or person so failing shall become liable for and forfeit to the State of Maryland a sum of not less than $10 nor more than $500, with an extra fine of not less than $5 nor more than $50 per day for each day beyond the time limit that said order is not complied with. All penalties are to be recovered by the State in civil action brought by the State of Maryland, and such penalty when collected shall be paid into the State treasury.

288. *Employment of force to carry out act.*—The State board of health shall be empowered to employ and fix the compensation of such experts, engineers, clerical, and other assistants as it may deem necessary to carry out the provisions of this subtitle: *Provided, however*, That all the expenses, for salaries or otherwise, incurred under the provisions of this subtitle shall not exceed in the aggregate the amount appropriated by this subtitle.

[ACTS OF 1916, CHAP. 313.]

SECTION 1. *Creating "Washington Suburban Sanitary District."*—All that part of Prince Georges and Montgomery Counties within the following bounds—within the bounds as described on the drawing entitled "State of Maryland, Montgomery and Prince Georges Counties Sewerage Commission, Proposed Washington Suburban Sanitary District, Main Drainage Systems," Plate 1, and dated January, 1914, on file in the office of the State department of health of Maryland, being those sections of Montgomery and Prince Georges Counties adjacent to the District of Columbia and comprising all of the drainage areas of Little Falls Branch and Oxon Run, and all of the territory drainage to Rock Creek, south of a point one-half mile north of the bridge spanning Rock Creek on the road running northeast from Garrett Park, and all of the territory draining to the Anacostia River and its tributaries south of the confluence of Indian Creek and Beaverdam Creek, south of the confluence of Paint Branch and Little Paint Branch, and south of a point one-half mile north of the road crossing Northwest Branch at Burnt Mills, be, and the same is hereby, incorporated for the purposes hereinafter set forth, to be known as "The Washington Suburban Sanitary District."

SEC. 2. *Commission to be appointed.*—The investigations for and design of water supply, sewerage, and drainage systems in said district shall be under the jurisdiction of a commission of three members, one to be appointed by the county commissioners of Prince Georges County, and one to be appointed by the county commissioners of Montgomery County, both upon the recommendation of the State board of health, on or before June 15, 1916, and the third to be appointed by the governor June 15, 1916. The appointees of the respective county commissioners shall be residents and taxpayers of said sanitary district, and all shall serve for two years. * * *

SEC. 3. *Commission to design water supply, drainage, and sewerage systems.*—As soon after organization as possible said commission shall proceed to cause the required surveys to be made and to divide the said sanitary district into water, sewerage, and drainage districts, and to designate the same, in the case of sewerage or drainage districts following the natural drainage areas, or parts thereof, as near as may be. They shall thereupon proceed to have field investigations, studies, plats, plans, diagrams, estimates, and specifications made for the water supply, sewerage, and drainage of all such districts, and shall determine the approximate cost thereof for each district.

SEC. 4. *Commission to report to 1918 legislature.*—Said commission shall present to the legislature of 1918 a detailed report covering its activities, and shall prepare and submit to the legislature a bill setting forth the best means of proceeding with the construction and operation of the water supply, sewerage, and drainage systems proposed for the sanitary district.

SEC. 5. *Commission to explain to public needs as to water supply, etc.*—Said commission shall be charged with the duty of explaining to the public the advantage and necessity of constructing comprehensive water supply, sewerage, and drainage systems within the sanitary district, and shall hold public hearings whenever they deem it necessary for the discussion of the legislation to be proposed, as provided under section 4.

SEC. 6. *Commission may negotiate with proper authorities of District of Columbia.*—Said commission shall have full power and authority to negotiate with the proper authorities of the District of Columbia with regard to the connection of the proposed sewers of the counties with those of the District of Columbia,

or vice versa, or with regard to any other matter necessary for the proper construction or operation of the water and sewer systems by them designed.

SEC. 10. *Act not meant to restrict control of State board of health.*—Nothing herein provided shall be taken as restricting any control which the State board of health is empowered by law to exercise within the sanitary district.

SEC. 12. *Mount Rainier not affected by act.*—Nothing herein contained shall affect the town of Mount Rainier, Md., nor the property included within the limits of said town, nor its municipal corporation, known as the mayor and common council of Mount Rainier, nor the provisions of chapter 94 of the Acts of Assembly of 1916, providing for sewerage and water system for said town.

[ENFORCEMENT OF FOOD AND DRUGS ACT. REG. BD. OF H., REVISED TO NOV. 8, 1912.]

Regulation No. 15—Oysters.—Oysters to which ice or water has been added will be deemed adulterated, and oysters, clams, or other shellfish taken from unsanitary or polluted beds, or packed under unsanitary conditions will be considered adulterated in that they contain an added poisonous or other deleterious ingredient. * * *

MASSACHUSETTS.

[REVISED LAWS, 1902, CHAP. 25.]

14. *Town may aid in building system of sewers in its watershed.*—A town may make contracts for the exercise of its corporate powers and for the following purposes:

* * * To contribute to the cost of building, by any other city or town situated in the watershed of its water supply, a sewer or system of sewers to aid in protecting such water supply from pollution.

[REVISED LAWS, 1902, CHAP. 26.]

18. *Inspection of ice.*—A city may establish ordinances to secure the inspection of ice sold within its limits and to prevent the sale of impure ice, and may affix penalties of not more than $20 for each violation thereof.

[REVISED LAWS, 1902, SUPPLEMENT, 1908, CHAP. 75.]

59. *State department of health may issue orders to preserve purity of ice.*—The State board of health,[1] upon complaint in writing of not less than 25 consumers of ice cut from any pond or stream and sold or held for sale, alleging that said ice is impure and injurious to health, after notice to the parties interested of the time and place appointed for the hearing, and after hearing said parties, may make such orders relative to the sale of said ice as in its judgment the public health requires.

60. *How orders are to be served and enforced.*—Such orders shall be served upon any person who sells or offers for sale impure ice, and may be enforced in equity by the supreme judicial court or the superior court.

61. *Appeal from orders.*—A person who is aggrieved by such orders may appeal therefrom in the manner prescribed by section 95, and shall be subject to the provisions of sections 96 and 97, and the court may award costs in its discretion.

95. *How appeal must be made.*—Whoever is aggrieved by an order passed under the provisions of section 91 or 109[2] may, within three days after the serv-

[1] Changed to department of health by acts of 1914, chap. 792.

[2] As these sections do not relate to stream pollution, they are not quoted.

ice of the order upon him, give written notice of appeal to the board and file a petition for a jury in the superior court in the county in which the premises affected are located, and, after notice to the board, may have a trial at the bar of the court in the same manner as other civil cases are tried by jury. If, by mistake of law or fact or by accident, he fails within said three days to apply as aforesaid, and if it appears to the court that such failure was caused by such mistake or accident, and that he has not, since the service of such order upon him, violated it, he may within 30 days after the service of the order upon him apply for a jury.

96. *Trade not to be exercised during appeal.*—Such trade or employment shall not be exercised contrary to the order while such proceedings are pending, unless specially authorized by said board, and if so specially authorized all further proceedings by said board shall be stayed while such proceedings are pending. Upon any violation of the order, unless specially authorized as aforesaid, the proceeding shall forthwith be dismissed.

112. *State department of health to have oversight of inland waters, etc.*—The State * * * [department] of health shall have the general oversight and care of all inland waters and of all streams and ponds used by any city, town, or public institution or by any water or ice company in this Commonwealth as sources of water supply, and of all springs, streams, and water courses tributary thereto. It shall be provided with maps, plans, and documents suitable for such purposes and shall keep records of all its transactions relative thereto.

113 (as amended by chap. 467 of the Laws of 1907). *State department to have inland waters examined and to make rules to prevent pollution.*—Said * * * [department] may cause examinations of such waters to be made to ascertain their purity and fitness for domestic use or their liability to impair the interests of the public or of persons lawfully using them or to imperil the public health. It may make rules and regulations to prevent the pollution and to secure the sanitary protection of all such waters as are used as sources of water supply. Said * * * [department] may delegate the granting and withholding of any permit required by such rules or regulations to State boards and commissions and to selectmen in towns and to boards of health, water boards, and water commissioners in cities and towns to be exercised by such selectmen, boards, and commissions, subject to such recommendation and direction as shall be given from time to time by the State * * * [department] of health; and upon complaint of any person interested said board shall investigate the granting or withholding of any such permit and make such orders relative thereto as it may deem necessary for the protection of the public health.

114. *Publication of order to be evidence of notice.*—The publication of an order, rule, or regulation made by the * * * [department] under the provisions of the preceding section or section 118 in a newspaper of the city or town in which such order, rule, or regulation is to take effect or, if no newspaper is published in such city or town, the posting of a copy of such order, rule, or regulation in a public place in such city or town shall be legal notice to all persons, and an affidavit of such publication or posting by the person causing such notice to be published or posted, filed, and recorded with a copy of the notice in the office of the clerk of such city or town shall be admitted as evidence of the time at which and the place and manner in which the notice was given.

115. *State board to report to general court.*—Said * * * [department] shall annually, on or before the 10th day of January, make a report to the

general court of its doings for the preceding year, recommend measures for the prevention of the pollution of such waters and for the removal of polluting substances in order to protect and develop the rights and property of the Commonwealth therein and to protect the public health and recommend any legislation or plans for systems of main sewers necessary for the preservation of the public health and for the purification and prevention of pollution of the ponds, streams, and inland waters of the Commonwealth. It shall also give notice to the attorney general of any violation of law relative to the pollution of water supplies and inland waters.

116. *State board may appoint employees.*—Said * * * [department] may appoint, employ, and fix the compensation of such agents, clerks, servants, engineers, and expert assistants as it considers necessary. Such agents and servants shall cause the provisions of law relative to the pollution of water supply and of the rules and regulations of said board to be enforced.

117. *State board to consult with local authorities.*—Said * * * [department] shall consult with and advise the authorities of cities and towns and persons having, or about to have, systems of water supply, drainage, or sewerage as to the most appropriate source of water supply, and the best method of assuring its purity or as to the best method of disposing of their drainage or sewage with reference to the existing and future needs of other cities, towns, or persons which may be affected thereby. It shall also consult with and advise persons enaged or intending to engage in any manufacturing or other business whose drainage or sewage may tend to pollute any inland water as to the best method of preventing such pollution, and it may conduct experiments to determine the best methods of the purification or disposal of drainage or sewage. No person shall be required to bear the expense of such consultation, advice, or experiments. Cities, towns, and persons shall submit to said board for its advice their proposed system of water supply or of the disposal of drainage or sewage, and all petitions to the general court for authority to introduce a system of water supply, drainage, or sewerage shall be accompanied by a copy of the recommendation and advice of said board thereon. In this section the term "drainage" means rainfall, surface and subsoil water only, and "sewage" means domestic and manufacturing filth and refuse.

118. *State board to issue orders to prevent pollution of streams.*—Upon petition to said * * * [department] by the mayor of a city or the selectmen of a town, the managing board or officer of any public institution, or by a board of water commissioners, or the president of a water or ice company, stating that manure, excrement, garbage, sewage, or any other matter pollutes or tends to pollute the waters of any stream, pond, spring, or watercourse used by such city, town, institution or company as a source of water supply, the * * * [department] shall appoint a time and place within the county where the nuisance or pollution is alleged to exist for a hearing, and after notice thereof to parties interested and a hearing, if in its judgment the public health so requires, shall, by an order served upon the party causing or permitting such pollution, prohibit the deposit, keeping, or discharge of any such cause of pollution, and shall order him to desist therefrom and to remove any such cause of pollution; but the board shall not prohibit the cultivation and use of the soil in the ordinary methods of agriculture if no human excrement is used thereon. Said * * * [department] shall not prohibit the use of any structure which was in existence on the 11th day of June in the year 1897 upon a complaint made by the board of water commissioners of any city or town or by any water or ice company unless such board of water commissioners or company files with the State * * * [department] a vote of its city council, selectmen, or company, respectively, that such city, town, or com-

pany will at its own expense make such changes in said structure or its location as said board shall deem expedient. Such vote shall be binding on such city, town, or company. All damages caused by such changes shall be paid by such city, town, or company; and if the parties can not agree thereon, the damages shall, on petition of either party, filed within one year after such changes are made, be assessed by a jury in the superior court for the county where such structure is located.

119. *Appeal from preceding order.*—Whoever is aggrieved by an order passed under the provisions of the preceding section may appeal therefrom in the manner provided in sections 95 and 97; but such notice as the court shall order shall also be given to the board of water commissioners and mayor of the city or chairman of the selectmen of the town or president or other officer of the water or ice company interested in such order. While the appeal is pending the order of the board shall be complied with, unless otherwise authorized by the * * * [department].

120. *Court jurisdiction.*—The supreme judicial court or the superior court shall have jurisdiction in equity, upon the application of the State * * * [department] of health, or of any party interested, to enforce its orders, or the orders, rules, and regulations of said * * * [department] of health, and to restrain the use or occupation of the premises or such portion thereof as said * * * [department] may specify, on which said material is deposited or kept, or such other cause of pollution exists, until the orders, rules, and regulations of said * * * [department] have been complied with.

121. *Agents of State board may enter premises to carry out above—Compensation.*—The agents and servants of said * * * [department] may enter any building, structure, or premises for the purpose of ascertaining whether sources of pollution or danger to the water supply there exist, and whether the rules, regulations, and orders aforesaid are obeyed. Their compensation for services rendered in connection with proceedings under the provisions of section 118 shall be fixed by the * * * [department] and shall in the first instance be paid by the Commonwealth; but the whole amount so paid shall, at the end of each year be justly and equitably apportioned by the tax commissioner between such cities, towns, or companies, as during said year have instituted said proceedings, and may be recovered in an action by the treasurer and receiver general, with interest from the date of the demand.

122. *Penalty.*—Whoever violates any rule, regulation, or order made under the provisions of section 113 or 118 shall be punished for each offense by a fine of not more than $500, to the use of the Commonwealth, or by imprisonment for not more than one year, or by both such fine and imprisonment.

123 (as amended by acts of 1910, chapter 550). *Exception to above provisions.*—The provisions of the preceding 11 sections shall not apply to the Connecticut River. The provisions of the preceding five sections and of so much of sections 112 to 117, inclusive, as refers to domestic water supplies, shall not apply to the Merrimac River, nor to so much of the Concord River as lies within the limits of the city of Lowell, nor to springs, streams, ponds, or watercourses over which the metropolitan water and sewerage board has control.

124. *Pollution of streams above intake of water supplies.*—No sewage, drainage, refuse, or polluting matter of such kind and amount as either by itself or in connection with other matter will corrupt or impair the quality of the water of any pond or stream used as a source of ice or water supply by a city, town, public institution, or water company for domestic use, or render it injurious to health, and no human excrement shall be discharged into any such stream or pond, or upon their banks if any filter basin so used is there situated, or into

any feeders of such pond or stream within 20 miles above the point where such supply is taken.

125. *Exception to previous section.*—The provisions of the preceding section shall not destroy or impair rights acquired by legislative grant prior to the 1st day of July in the year 1878, or destroy or impair prescriptive rights of drainage or discharge to the extent to which they lawfully existed on that date; nor shall it be applicable to the Merrimac or Connecticut Rivers, or to so much of the Concord River as lies within the limits of the city of Lowell.

126. *Court jurisdiction.*—The supreme judicial court or the superior court, upon application of the mayor of a city, the selectmen of a town, managing board or officer of a public institution, or a water or ice company interested, shall have jurisdiction in equity to enjoin the violation of the provisions of section 124.

127. *Willful defiling of springs, etc.—Penalty.*—Whoever willfully and maliciously defiles or corrupts any spring or other source of water or reservoir, or destroys or injures any pipe, conductor of water, or other property pertaining to an aqueduct, or aids or abets in any such trespass, shall be punished by a fine of not more than $1,000, or by imprisonment for not more than one year.

128. *Befouling water supplies, etc.—Penalty.*—Whoever willfully deposits excrement or foul or decaying matter in water which is used for the purpose of domestic water supply, or upon the shore thereof within 5 rods of the water, shall be punished by a fine of not more than $50, or by imprisonment for not more than 30 days; and a police officer or constable of a city or town in which such water is wholly or partly situated, acting within the limits of his city or town, and any executive officer or agent of a water board, board of water commisssioners, public institution, or water company furnishing water or ice for domestic purposes, acting upon the premises of such board, institution, or company, and not more than 5 rods from the water, may, without a warrant, arrest any person found in the act of violating the provisions of this section, and detain him until a complaint can be made against him therefor. But the provisions of this section shall not interfere with the sewage of a city, town, or public institution, or prevent the enriching of land for agricultural purposes by the owner or occupant thereof.

129. *Prohibiting bathing in city reservoirs, etc.*—Whoever bathes in a pond, stream, or reservoir, the water of which is used for the purpose of domestic water supply for a city or town, shall be punished by a fine of not more than $10.

(Supplemented by acts of 1908, chapter 539, as follows:)

Bathing in water supplies.—Any police officer or constable of a city or town in which any pond, stream, or reservoir used for the purpose of domestic water supply is wholly or partly situated, acting within the limits of his city or town, and any executive officer of a water board, board of water commissioners, public institution, or water company, furnishing water for domestic purposes, or agent of such water board, board of water commissioners, public institution, or water company, duly authorized in writing therefor by such boards, institution, or company, acting upon the premises of such board, institution, or company and not more than 5 rods from the water, for such supply may, without a warrant, arrest any person found in the act of bathing in a pond, stream, or reservoir, the water of which is used for the purpose aforesaid, and detain him in some convenient place until a complaint can be made against him therefor.

130. ***Animals not to be driven on ice of pond or stream used as water supply.***—Whoever, not being engaged in cutting or harvesting ice, or in hauling logs, wood, or lumber, drives any animal on the ice of a pond or stream which is used for the purpose of domestic water supply for a city or town shall be

punished by a fine of not more than $50 or by imprisonment for not more than 30 days.

141. (Supplemented by acts of 1908, chapter 499:)

SEC. 1 (as amended by acts of 1911, chapter 135). *Cities, etc., may take lands to protect water supply.*—Cities, towns, water supply, and fire districts duly established by legislative authority may, with the consent and approval of the State board of health, given after due notice and a hearing, take, or acquire by purchase or otherwise, and hold any lands, buildings, rights of way, and easements within the watershed of any pond, stream, reservoir, well, or other water used by them as a source of water supply, which said board may deem necessary to protect and preserve the purity of the water supply.

SEC. 2 (as amended by acts of 1911, chapter 135). *Description of lands taken.*—If any lands, buildings, rights of way, or easements are taken under authority hereof, the city, town, water supply, or fire district shall, within 90 days thereafter, file and cause to be recorded in the registry of deeds for the county or district in which the same are situated, a description thereof sufficiently accurate for identification, with a statement of the purpose for which the same are taken, signed by the water commissioners of said city, town, or district. Upon the filing of said description and statement the title in fee simple to the lands, buildings, rights, or easements so taken, shall vest in the city, town, or district. All lands taken, purchased, or otherwise acquired under the provisions of this act shall be under the control of the board of water commissioners of the city, town, or district acquiring the same, who shall manage and improve them in such manner as they shall deem for the best interest of the city, town, or district.

SEC. 3. *Damages.*—Cities, towns, and districts shall pay all damages sustained by any person or corporation by the taking of any lands, buildings, rights, or easements under the authority of this act; and if the parties can not agree upon the amount of the same, they may be recovered in the manner provided by law in the case of land taken for the laying out of highways: *Provided*, That application therefor is made within three years after the said taking.

SEC. 4. *Damages to be paid out of proceeds of bonds.*—All damages to be paid by a city, town, or district by reason of any act done under the authority of this act may be paid out of the proceeds of the sale of any bonds authorized by law to be issued by such city, town, or district for water-supply purposes or from any surplus income of the water works available for the purpose.

SEC. 5 (as amended by acts of 1911, chapter 135). *Valuation of land taken, etc.*—After the actual taking by a city, town, water supply, or fire district of property in another city or town for the purposes of this act, the same may be valued by the assessors of the city or town in which such property is situated on the basis of the average of the assessed value of the land and buildings for the three years preceding the acquisition thereof, the valuation for each year being reduced by all abatements thereon; but any part of such land or buildings from which any revenue in the nature of rent is received shall be subject to taxation, and the city, town, water supply or fire district acquiring such property shall pay to the city or town in which it is situated taxes or sums in lieu of taxes at the rate per thousand of all taxes in such city or town for that year on the valuation so determined. Cases of dispute as to valuations arising under this act shall be governed by the provisions of sections 11 and 12 of chapter 12 of the Revised Laws, and of all amendments thereof now or hereafter made.[1]

[1] It does not appear necessary, for the purposes of this compilation, to quote sections referred to.

[REVISED LAWS, 1902, SUPPLEMENT, 1908, CHAP. 78.]

(Supplemented by acts of 1908, chapter 379, as follows:)

30. SEC. 2. *Plans to be approved by State department of health.*—No land other than that so used and appropriated at the time of the passage of this act shall be used for the purpose of burial if it be so situated that surface water or ground drainage therefrom may enter any stream, pond, reservoir, well, filter gallery, or other water used by a city, town, or water company as a source of public water supply, or any tributary of a source so used, or any aqueduct or other works used in connection therewith, until a plan and description of the lands proposed for such use have been submitted to the State * * * [department] of health and approved in writing by said * * * [department].

[REVISED LAWS, 1902, SUPPLEMENT, 1908, CHAP. 91.]

113. *Taking of shellfish from contaminated waters.*—The State * * * [department] of health may examine all complaints which may be brought to its notice relative to the contamination of tidal waters and flats in this commonwealth by sewage or other causes, may determine, as nearly as may be, the bounds of such contamination, and, if necessary, mark such bounds. It may also, in writing, request the commissioners on fisheries and game to prohibit the taking from such contaminated waters and flats of any oysters, clams, quahaugs, and scallops. Upon receipt of such request, said commissioners shall prohibit the taking of such shellfish from such contaminated waters or flats for such period of time as the State * * * [department] of health may prescribe.

(Affected by acts of 1907, chapter 285, as follows:)

SEC. 1. *Boards of health may grant permits to take clams or quahaugs for bait.*—Whenever, upon the request of the State * * * [department] of health, under the provisions of section 113 of chapter 91 of the Revised Laws, the commissioners on fisheries and game have prohibited or may hereafter prohibit the taking from contaminated waters or flats in any city or town of any clams or quahaugs, the board of health of such city or town may grant permits in writing to any person to take from such waters clams or quahaugs to be used for bait only, and in such quantities and upon such conditions as they shall express in their permit.

SEC. 2. *Person holding permit to keep same on his person.*—Any person holding a permit from the board of health of a city or town shall keep in his possession, and on his person, while acting thereunder, any permit obtained by him from said board of health, and shall at all times display the same upon the request of any person authorized to enforce the provisions of this act. Violation of this section shall be punished by a fine of not less than $10 nor more than $50, and in addition the permit shall be revoked and shall not thereafter be issued within 12 months.

SEC. 3. *When permit is to be forfeited.*—Any person who violates any of the provisions of such permit shall forfeit the permit and shall be punished by a fine not exceeding $100, or by imprisonment for a term not exceeding three months, or by both such fine and imprisonment.

SEC. 4 (as amended by acts of 1913, chap. 504). *Penalty for sale of clams from polluted waters.*—Whoever sells, or exchanges, or exposes or offers for sale or exchange, or buys any clams or quahaugs taken from waters proscribed as contaminated and subject to the provisions of section 113 of chapter 91 of the Revised Laws, shall be punished by a fine of not more than $100, or by im-

prisonment for a term not exceeding three months, or by both such fine and imprisonment.[1]

133 (as amended by acts 1913, ch. 439). *Penalty for killing fish with poisons.*—Whoever puts or throws into any waters for the purpose of taking or destroying fish therein any poisonous substance, simple, mixed or compound, * * * shall be punished by a fine not exceeding $500 or by imprisonment for a term not exceeding one year for each offense: *Provided, however,* That the provisions of this act shall not apply to operations of the Federal Government, of the State Government, or of any municipal Government in this commonwealth * * *.

114. *Penalties.*—Whoever takes any oysters, clams, quahogs, or scallops from tidal waters or flats from which the taking has been prohibited as provided in the preceding section [sec. 113] shall forfeit not less than $5 nor more than $10 for the first offense, and not less than $50 nor more than $100 for each subsequent offense; but such penalties shall not be incurred until one week after the commissioners on fisheries and game shall have caused notice of such prohihibition, with a description, or the bounds, of the tidal waters or flats to which such prohibition applies, to be published in a newspaper published in the town or country in which or adjacent to which the tidal waters or flats to which such prohibition applies are situated.[2]

[REVISED LAWS, 1902, CHAP. 207.]

28. *Poisoning springs, etc.*—Whoever * * * willfully poisons any spring, well or reservoir of water with such intent [intent to kill or injure another person], shall be punished by imprisonment in the State prison for life or for any term of years.

[REVISED LAWS, 1902, CHAP. 208.]

92. *Injury to ice.*—Whoever, willfully, intentionally and without right or license, cuts, injures, mars or otherwise damages or destroys ice upon waters from which ice is or may be taken as an article of merchandise, whereby the taking thereof is hindered or the value thereof diminished for that purpose, shall be punished by a fine of not more than $100.

[ACTS OF 1909, CHAP. 819.]

SECTION 1. *Supervision of water companies.*—Upon complaint in writing relative to the service furnished in any city or town or the charges therefor made by any company engaged in the business of supplying water to such city or town or to the inhabitants thereof, signed by the mayor of the city or the selectmen of the town or by 50 customers of the company and filed in the office of the State * * * [department] of health, said * * * [department] shall notify the company by leaving at its office or place of business in such city or town a copy of the complaint and may thereupon, after notice, give a public hearing to the complainant or complainants and to the company, and shall require the company to furnish such information in its possession as may be necessary to determine the matters involved in the complaint, and,

[1] Foregoing act (acts of 1907, chap. 285) was repealed in part by acts of 1911, chap. 410, which established a board of shellfish commissioners for the city of New Bedford and the town of Fairhaven. The repealing section (sec. 10) reads as follows: "Chapter 285 of the acts of the year 1907 is hereby repealed so far as it relates to the flats and waters included within the provisions of this act."

[2] Sec. 114 apparently repealed in part by sec. 4 of acts of 1907, chap. 285, as amended by acts of 1913, chap. 504. (See above.)

after the hearing, may make such recommendations concerning the reduction, modification, or continuation of such charges for service or concerning improvements in the quality of the service or extensions of the same or concerning other matters in the premises as the board shall deem just and proper. Any such recommendations shall be transmitted in writing by the * * * [department] to the company complained of, and a report of the proceedings and of the result thereof shall be included in the annual report of the * * * [department] together with a statement of the action, if any, taken by the company upon the recommendation.[1]

[ACTS OF 1909, CHAP. 433.]

SEC. 1. *Regulating filter beds.*—Cities, towns, persons, firms, or corporations owning or operating filter beds or other works for the treatment or purification of sewage shall provide and maintain works adequate for the treatment of the sewage at all times, and shall operate such works in such manner as will prevent a nuisance therefrom or the discharge or escape of unpurified or imperfectly purified sewage or effluent into any stream, pond, or other water or other objectionable result.

SEC. 2. *Sewer commissioners may make regulations.*—The board of sewer commissioners or other board or officer, having charge of the sewers in cities and towns, shall have authority to make such regulations regarding the use of the sewers as are necessary to prevent the entrance or discharge therein of any substance which may tend to interfere with the flow of sewage or the proper operation of the sewerage system or disposal works.

SEC. 3. *State department of health may order changes in sewage-disposal system.*—The State * * * [department] of health, if convinced, upon examination, that a filter bed or other works for the treatment or purification of sewage causes the pollution of a stream, pond, or other water, or is likely to become a source of nuisance or create objectionable results in its neighborhood by reason of defective construction, inadequate capacity, or negligence or inefficiency in maintenance or operation or from other cause, may issue notice in writing to the city, town, or person owning or operating such works requiring such enlargement or improvement in the works or change in the method of operation thereof as may be necessary for the proper maintenance and operation of the works and the efficient purification and disposal of the sewage. In case the State * * * [department] of health is satisfied after investigation that the unsatisfactory operation of a sewage-disposal system is due wholly or partly to the discharge into the system of manufacturing waste or other substance of such character as to interfere with the efficient operation of said works, said * * * [department] may if necessary prohibit the entrance of such waste or other material or may regulate the entrance thereof into the system, or may require the treatment of such waste or other material in such manner as may be necessary to prevent its interference with the operation of the works.

SEC. 4. *Court jurisdiction.*—The supreme judicial court, or the superior court, shall have jurisdiction in equity to enforce the provisions of this act upon petition of the State board of health or of any party interested.

[ACTS OF 1909, CHAP. 505.]

SEC. 1. *Examination of the sanitary condition of the Merrimac River.*—The State * * * [department] of health shall at such times as it may deem proper

[1] See acts of 1914, chap. 787, two sections of which are quoted in this appendix, p. 252.

examine the bed, banks, and waters of the Merrimac River and of streams tributary or adjacent thereto in any city or town bordering upon said river or streams. Whenever the * * * [department] shall determine that the condition of said river or streams or of the banks thereof is injurious or dangerous to public health, or likely to become injurious or dangerous to public health, by reason of the entrance of sewage or of refuse from factories, or from other causes, said board shall prepare a plan or plans for removing the cause of such injury or danger, and shall report the same to the general court.

[ACTS OF 1910, CHAP. 460.]

SEC. 1. *Commissioners on fisheries and game may prohibit discharge of waste materials into certain streams.*—If the commissioners on fisheries and game determine that the fisheries of any brook or stream in this Commonwealth may be of sufficient value to warrant the prohibition or regulation of the discharge or escape of sawdust, shavings, garbage, ashes, acids, sewage, dyestuffs, and other waste material from any particular sawmill, manufacturing or mechanical plant, or dwelling house, stable, or other building, which may, directly or indirectly, materially injure such fisheries, they may by an order in writing to the owner or tenant of such sawmill, manufacturing or mechanical plant, dwelling house, stable, or other building prohibit or regulate the discharge or escape of sawdust, shavings, garbage, ashes, acids, sewage, dyestuffs, and other waste material therefrom into such brook or stream. Such order may be revoked or modified by them at any time. Before any such order is made said commissioners shall, after reasonable notice to all parties in interest, give a public hearing in the county where the sawmill, manufacturing or mechanical plant, dwelling house, stable, or other building to be affected by the order is located, at which hearing any citizens shall have the right to be heard on the questions to be determined by the commissioners. Upon petition of the party aggrieved by such order, filed within six months after the date thereof, the superior court, sitting in equity, may, after such notice as it may deem sufficient, hear all interested parties and annul, alter, or affirm the order. If such petition is filed by the party aggrieved by said order within 10 days after the date thereof said order shall not take effect until altered or affirmed as aforesaid. Whoever, having so been notified, discharges sawdust, shavings, garbage, ashes, acids, sewage, dyestuffs, and other waste materials, or suffers or permits it to be discharged or to escape from said plant under his control into a brook or stream in violation of the order of said commissioners or of said court, if an appeal is taken, shall be punished by a fine of not more than $25 for the first offense and of $50 for a second offense.

[ACTS OF 1911, CHAP. 655.]

SEC. 1. *State department of health authorized to make expenditure to protect public health in valley of Neponset River.*—The State * * * [department] of health is hereby authorized and directed to expend a sum not exceeding $150,000, exclusive of damages to land, easements, and rights in land, in constructing necessary drains, trenches, and ditches, and in dredging and deepening the channel of the Neponset River between the place where the river is crossed by Washington Street in Walpole and tide water, and within said limits to make changes and alterations in any bridge, dam, or other structure over, under, or across said waters, and to do any other work, except as hereinafter stated, which will tend to restore the lands along said river to their origi-

nal condition, and to abate malaria and other peril to the public health.[1]
* * *

[ACTS OF 1914, CHAP. 581.]

SEC. 1. *Pollution of Charles River prohibited.*—The metropolitan park commission is hereby authorized to make rules and regulations to prohibit the pollution of the Charles River within the metropolitan district.

SEC. 2. *Penalty.*—Any person or corporation violating any rule or regulation made under authority hereof shall be punished by a fine not exceeding $1,000.

[ACTS OF 1914, CHAP. 655.]

SECTION 1. *Entrance or discharge of sewage into Assabet River prohibited.*—The State board of health is hereby authorized and directed to prohibit the entrance or discharge of sewage into any part of the Assabet River or its tributaries and to prohibit the entrance or discharge therein of every other substance which may be injurious to public health or may tend to create a public nuisance.

SEC. 2. *State board of health to suggest means of rendering sewage harmless.*—The board shall consult and advise with the owner of any factory or other establishment, or any municipality discharging any substance into the Assabet River, at his or its request, or of its own motion, as to the best practicable and reasonably available means of rendering the waste or refuse therefrom harmless, and any order or finding by the board shall be prima facie evidence of compliance or noncompliance with the provisions of section 1 of this act.

SEC. 3. *Court jurisdiction.*—The supreme judicial court or any justice thereof, and the superior court or any justice thereof, shall have jurisdiction in equity to enforce the provisions of this act and of any order made by the State board of health in conformity therewith, and to enjoin the entrance or discharge into any part of the Assabet River or its tributaries of sewage or of any other substance which is, or which said board shall have determined may be, injurious to public health or tending to create a public nuisance. Proceedings to enforce any such order or to obtain such an injunction shall be instituted and prosecuted by the attorney general at the relation [sic] of the State board of health.

SEC. 4. Whoever, contrary to any order of the State board of health, permits the entrance or discharge into any part of the Assabet River or its tributaries of sewage or of any other substance injurious to public health or tending to create a public nuisance, shall be punished by a fine not exceeding $500 for each offense.

[ACTS OF 1914, CHAP. 787.]

SEC. 1. *Water companies to be supervised by gas and electric light commissioners.*—The board of gas and electric light commissioners shall have general supervision of all corporations and companies engaged in the distribution and sale of water in this Commonwealth and occupying the public streets with their mains and pipes for that purpose, and shall make all necessary examinations and inquiries and keep themselves informed as to the compliance by all such corporations and companies with the provisions of law. None of the members of said board shall be in the employ of or own any stock in any water cmpany

[1] As the connection between this matter and pollution of streams is very indirect, it has not seemed necessary to quote the rest of the act (secs. 2–12). For the same reason it has seemed unnecessary to quote acts of 1916, chap. 265, which relates to the same matter.

or be in any way, directly or indirectly, pecuniarily interested in the sale of water or of any article or commodity used for any purpose connected with the distribution and sale of water.

SEC. 12. *Repeal.*—Chapter 319 of the acts of the year 1909, and sections 20, 21, 22, 23, 24, 27, 28, 30, and 31 of chapter 109 of the revised laws are hereby repealed so far as they apply to the corporations and companies described in section 1 of this act. Nothing herein contained shall be construed to affect or impair the powers and duties of the State board of health with respect to water supply under the provisions of chapter 75 of the revised laws and all acts in amendment thereof and addition thereto.[1]

[ACTS OF 1914, CHAP. 792.]

SECTION 1. *Department of health created.*—There is hereby created a State department of health, which shall exercise all the powers and perform the duties now conferred and imposed by law upon the State board of health. The State department of health shall consist of a commissioner of health and a public health council. There shall also be directors of divisions, district health officers, and other employees as hereinafter provided.

SEC. 2. *Duties of commissioner.*—* * * The commissioner of health shall be the administrative head of the State department of health. His powers and duties shall be to administer the laws relative to health and sanitation and the regulations of the department; to prepare rules and regulations for the consideration of the public health council * * *.

SEC. 3. *Regulations of public health council.*—* * * It shall be the duty of the public health council to make and promulgate rules and regulations. * * *

[ACTS OF 1916, CHAP. 180.]

Section 1 of chapter 541 of the acts of the year 1902, as amended by section 1 of chapter 360 of the acts of the year 1906,[2] is hereby further amended by striking out the said section and inserting in place thereof the following:

SECTION 1. *Sewage and waste—Prevention of discharge or entrance into Neponset River.*—The State department of health is hereby authorized and directed to prohibit the entrance or discharge of sewage into any part of the Neponset River or its tributaries and to prevent the entrance or discharge therein of any other substance which may be injurious to the public health or may tend to create a public nuisance or to obstruct the flow of water, including all waste or refuse from any factory or other establishment where persons are employed, unless the owner thereof shall use the best practicable and reasonably available means to render such waste or refuse harmless.

MICHIGAN.

[HOWELL'S MICHIGAN STATUTES, 1912–13.[3]]

3082. *Appointment of medical inspectors.*—The State board of health is hereby authorized and empowered, whenever it becomes necessary to promote the work of the State board of health, to appoint any one of its members a State medical

[1] See acts of 1909, chap. 319, above.

[2] Amending law is given in full because acts of 1902, chap. 541, and acts of 1906, chap. 360, are not included in Supplement to Revised Code.

[3] At the end of each section is given the section number in the Compiled Laws of 1897, or the date of the act, if passed since 1897.

inspector, to the end that the rules and regulations adopted by said board for the preservation of public health may be strictly enforced in the various parts of the State. Any member of the board selected or appointed as a medical inspector, or any other person the board may so designate to act as a medical inspector, shall have the same right of inspection and the same authority in regard to all matters affecting the public health as has been or may be conferred upon the State or local boards of health. * * * (Act No. 293 of 1909.)

3083. *Duties of medical inspector.*—Every person selected to act as medical inspector shall act under the direction of the State board of health and shall make a thorough and complete investigation of all nuisances, * * * water supplies, the sewerage-disposal systems, * * * and such other work as is found necessary to improve the general sanitary and hygienic condition of the State. (Act No. 293 of 1909.)

3084. *Report.*—It shall be the duty of any person acting as such medical inspector after the completion of any investigation to immediately report in writing to the State board of health, upon such forms and in such manner as may be prescribed, a complete account of the essential facts disclosed by the investigation, together with the recommendations made and the work done to better safeguard the public health. (Act No. 293 of 1909.)

3178. *Regarding pollution of certain waters.*—It shall be unlawful for any person or persons to willfully or in any other manner knowingly to befoul, pollute, contaminate in any manner so as to render said water offensive for drinking purposes the waters of that stream situated in the townships of Adrian, Rome, and Cambridge, Lenawee County, Mich., and known commonly as Wolf Creek, or any tributary thereof situated in said county, at any place in said stream above the dam from which the water supply of the city of Adrian is taken. (Act No. 80 of 1899.)

3179. *What is meant by polluting waters referred to in section 3178.*—Whoever mischievously, maliciously, or willfully puts any dead animal, carcass or part thereof, or any other putrid, nauseous, noisome, or offensive substance in said stream or its tributaries, or in any other manner befouls the waters of said stream or its tributaries in an unwholesome or offensive manner, or shall drain the contents of any barnyard, waste-factory products, or other unwholesome substance into the water of said stream or its tributaries shall be deemed guilty of a violation of this act. (Act No. 80 of 1899.)

3180. *Penalty for violation.*—Any person convicted of a violation of this act [secs. 3178–3180] shall be punished by a fine not exceeding $100 and not less than $5 and costs of prosecution, and in default of the payment of said fine and costs he shall be imprisoned in the jail of Lenawee County not less than 10 nor more than 90 days, or both such fine and imprisonment in the discretion of the court. (Act No. 80 of 1899.)

4441. *Prohibiting pollution of waters where fish are taken.*—It shall be unlawful for all persons to put into any of the waters of this State, where fish are taken, any offal, blood, putrid brine, putrid fish, or filth of any description, and any person so offending shall be fined in any sum not exceeding $300 or imprisonment not exceeding 30 days, or both, at the discretion of the court: *Provided, however,* That this act shall not be construed to apply to discharging the waste matter of any paper mill into any of the streams or their tributaries on sections 13, 23, and 24 of Schoolcraft Township, Kalamazoo County. (Compiled Laws, sec. 5854, as amended by act No. 333, 1907.)

4442. *Burning of refuse accruing from curing of fish.*—All fish, offal, or filth of any description whatsoever accruing from the catching and curing of fish

shall be burned or buried 10 rods distant from the beach or shore of the river or lake. (Compiled Laws, sec. 5855.)

4444. *Prohibiting putting of stone, sand, bark, sawdust, etc., in certain waters.*—It shall be unlawful for any person or persons to put into any of the waters fronting or bordering land where fish are taken by the legal owner or occupant of such lands any vessel or ship ballast, stone, sand, coal, cinder, ashes, log slabs, decayed wood, bark, sawdust, or obstruction, or filth of any other description * * *. (Compiled Laws, sec. 5857.)

4445. *Penalties.*—Any person or persons offending against the provisions of section 10 of this act [sec. 4444] shall be deemed guilty of a misdemeanor, and on conviction thereof shall be liable to a fine not exceeding $100 or imprisonment in the county jail not more than 90 days, or both such fine and imprisonment, in the discretion of the court; * * *. (Compiled Laws, sec. 5858.)

4674. *Unlawful to use substance to stupefy fish.*—It shall not be lawful hereafter at any time to kill or destroy, or attempt to kill or destroy, any fish in any of the waters of the State of Michigan * * * by the use of Indian cockle or other substance or device which has a tendency to stupefy the fish. (Compiled Laws, sec. 5863.)

5629. *Powers of city in regard to pollution of streams.*—Every city incorporated under the provisions of this act shall * * * have the general powers and authority in this chapter mentioned; and the council may pass such ordinances in relation thereto and for the exercise of the same as they may deem proper, namely:

Twenty-third. To provide for clearing the rivers, ponds, canals, and streams of the city, and the races connected therewith, of all driftwood and noxious matter; to prohibit and prevent the depositing therein of any filth or other matter tending to render the waters thereof impure, unwholesome, and offensive. (Compiled Laws, sec. 3107.)

5668. *City councils may preserve purity of water supplies.*—The council [of any city] shall have authority to provide by ordinance for the preservation of the purity of the waters of any harbor, river, or other waters within the city and within one-half of a mile from the corporate boundaries thereof; to prohibit and punish the casting or depositing therein of any filth, logs, floating matter, or any injurious thing; * * *. (Compiled Laws, sec. 3146.)

6025. *Village councils may preserve purity of water supplies.*—The council [of any village] shall have authority to provide by ordinance for the preservation of the purity of the waters of any harbor, river, or other waters within the village, * * *. (Compiled Laws, sec. 2806.)

7825. *Use of streams for washing ores.*—Whenever any mining corporation shall erect and maintain, or has heretofore erected and still maintains, any stamp mill for the purpose of stamping, breaking, or crushing any ores or rock containing copper, iron, silver, or any other mineral, or any of the ores thereof, and which shall require the use of water for the purpose of washing, separating, cleansing, or purifying the same, such corporation shall have the right to use for that purpose any stream or body of water which flows upon or across the lands owned or occupied by such corporation: *Provided*, That nothing herein contained shall be construed as exempting any such corporation from liability to any person or corporation for any damages that may be sustained by reason of the use of any stream or body of water for the purposes aforesaid. (Compiled Laws, sec. 7109.)

7826. *Injunction to prevent use of such water prohibited.*—No injunction shall issue for the purpose of enjoining or restraining any corporation from using the water in any stream or body of water in the manner and for the

purposes contemplated by this act [secs. 7825–7826]: *Provided*, That the provisions of this section shall not apply to any insolvent corporation, but if any injunction shall be issued against any such insolvent corporation engaged in the business contemplated by this act, the same shall be dissolved upon the giving such bond as the court may direct and approve, conditioned for the payment of any judgment that may be obtained at law against it for any damages arising from the use of such stream or body of water. (Compiled Laws, sec. 7110.)

14549. *Prohibiting poisoning of water supplies.*—If any person shall * * * willfully poison any spring, well, or reservoir of water with such intent [to kill or injure any other person], he shall be punished by imprisonment in the State prison for life, or any term of years. (Compiled Laws, sec. 11496.)

14851. *Penalty for putting dead animals into streams, etc.*—If any person or persons shall put any dead animal or part of the carcass of any dead animal into any lake, river, creek, pond, * * * every person so offending shall be deemed guilty of a misdemeanor, and upon conviction thereof shall forfeit and pay a sum not less than $5 nor more than $10, together with the costs of prosecution, and in default in the payment thereof shall be imprisoned in the county jail of the county in which such conviction may be had, not exceeding 10 days, to be imposed by any court of competent jurisdiction * * *. (Compiled Laws, sec. 11432.)

[Act No. 98 of 1913.]

Section 1. *State board of health to have supervision over water and sewage disposal systems.*—The State board of health is hereby given supervisory and visitorial power and control as limited in this act over all corporations, both municipal and private, partnerships, and individuals engaged in furnishing water to the public for household or drinking purposes, and over the plants and systems owned or operated by such municipal or private corporations, partnerships, or individuals. The word "corporation," as hereinafter used in this act, shall be taken to mean and include municipal corporations as well as private corporations.

Sec. 2. *State board to have authority to inspect pumping plants, etc.*—The State board of health, its agents and representatives, shall have the power and authority to enter upon, at all reasonable times, the pumping plants, filtering plants, reservoirs, standpipes, cribs, and other property of such corporations, partnerships, or individuals for the purpose of inspecting the same and carrying out the authority vested in them by this act.

Sec. 3. *State board to make regulations.*—The State board of health shall have authority to make and enforce such rules and regulations as it may deem necessary governing and providing a method of conducting and operating the entire or any part of the systems of waterworks, including the filtration plants owned or operated by such corporations, partnerships, or individuals, and may make and enforce penalties for the noncompliance with such rules and regulations; and said board shall, in addition to the other powers vested in it, whenever it shall deem it necessary for the protection of health, have authority to direct such corporations, partnerships, or individuals operating waterworks systems to cleanse any portion of such systems as it may deem necessary and to operate the same in such manner as to furnish pure and wholesome water and to enforce such directions by rule or regulations.

Sec. 4. *State board to investigate complaints made by certain authorities.*—Whenever the mayor of a city, president of a village, supervisor of a township, health officer, or representative of the State board of health has reason to be-

lieve that the water furnished by any corporation, partnership, or individual is contaminated, then it shall be the duty of the State board of health, upon the request of such officer, to investigate the same and to determine by laboratory analysis the condition of said water, and the certificate of the State bacteriologist, showing result of such analysis, shall be prima facie evidence of the matters stated in such certificate and also as to the source of the water and the time and place of taking, and of all matters that may be stated in said certificate.

SEC. 5. *Locality to pay for expenses of such investigation.*—The expenses of the investigation and analysis made by the State board of health shall be borne by the locality and shall be paid for at the rate of $5 per day and necessary traveling expenses while making such investigation and analysis, and shall constitute a charge against the city, village, or township asking for such investigation, the said per diem to be covered into the State treasury to the credit of the State board of health laboratory fund in addition to the amount already appropriated.

SEC. 6. *Copy of plans for water and sewage-disposal systems to be filed with State board of health.*—It shall be the duty of the mayor of each city, the president of each village, and of all private corporations, partnerships, or individuals now or hereafter operating waterworks systems in this State, to file with the State board of health a true and correct copy of the plans and specifications of the entire system owned or operated by such corporation, partnership, or individual, including such filtration or other purification plant as may be operated by them in connection therewith, and also plans and specifications of all alterations, additions, or improvements to such systems which may be made from time to time. The plans and specifications herein referred to shall, in addition to all other things, show all the sources through or from which water is or may be at any time pumped or otherwise permitted or caused to enter into such system. Such plans and specifications shall be certified by the mayor and city engineer of city corporations, by the president and engineer, if one is employed, for village corporations, and by such proper officer and the engineer employed by a private corporation for private corporations, and by some individual member of a partnership, or by the individual owner in case of waterworks owned and operated by partnerships or individuals, including the engineer employed, if any. If within 60 days after this act shall take effect, or within 60 days after any corporation, partnership, or individual shall commence to operate, or within 60 days after any alterations, additions, or improvements shall be made by such corporation, partnership or individual, and municipal officer or other person whose duty it is to file the same under the provisions of this act, shall willfully fail to file a copy of the plans and specifications as provided herein, or shall knowingly file false or incomplete copies of such plans and specifications, such officer or person shall be deemed guilty of a misdemeanor and shall be subject to a fine of not less than $25 and not more than $100, or to imprisonment in the county jail not more than 30 days, or to both such fine and imprisonment, and in addition thereto shall be subject to a penalty of $25 for each and every day such person or officer shall fail or neglect to file such plans and specifications, which penalty may be collected in any court of competent jurisdiction on the complaint of any member of the State board of health, and it shall be the duty of the attorney general to prosecute such complaint, and any penalties recovered shall be deposited in the general fund of the State.

SEC. 7. *Definition.*—The words "plans and specifications" as used in this act shall be construed to mean a true description or representation of the entire systems operated by such corporation, partnership, or individual as the same

shall be actually in use at the time of filing the same, and also a full and fair statement of how the same is operated: *Provided*, That any corporation, partnership, or individual that has already filed with the State board of health such plans and specifications as are required by section 6 of this act shall not be required to file such plans and specifications.

SEC. 8. *Annual reports required of plants having beds, etc., to be cleansed.*—In case of corporations, partnerships, or individuals operating filtration plants in which there are beds or other appliances to be cleansed, it shall be the duty of such corporations, partnerships, or individuals to file with the State board of health an annual report under oath on or before the 1st of January in each year, showing the dates on which and the number of times such beds or appliances were cleansed during the preceding year. Such report shall be sworn to by any municipal officer or person acquainted with the facts and employed by such corporation, partnership, or individual at the time of making said report. In the case of a municipal corporation, it shall be the duty of the clerk thereof to prepare and forward such report. Any person making a false statement in such annual report shall be deemed guilty of and subject to the penalty of perjury.

SEC. 9. *Violation of act a misdemeanor unless otherwise provided.*—Any corporation other than municipal, any partnership company or individual, or any officer of any municipal corporation having the duty imposed upon him by this act, who shall violate any provision of this act where no other penalty is provided therein, shall be guilty of a misdemeanor and shall be punished therefor as provided by law.

SEC. 10. *State board to inspect water supplies and make recommendations.*—It shall be the duty of the State board of health, on receipt of the plans and specifications of such waterworks systems, to inspect the same with reference to their effect upon the public health, and if such board on such inspection finds that the public water supply of any such city or village is impure and dangerous to individuals or to the public generally, the said board on its order may require the corporation, partnership, or individual owning and operating the same to make such alterations in such waterworks systems as may be required or advisable in the opinion of said board, in order that the water supply may be healthful and free of pollution. Such recommendations or orders of the State board of health shall be served in writing upon such corporations, partnerships, or individuals, and it shall thereupon be the duty of such corporations, partnerships, or individuals to comply with such recommendations or orders.

SEC. 11. The State board of health shall have the same power of visitation, inspection, direction, and control over the sewage-disposal systems of the cities and villages of this State as is herein given with respect to the waterworks systems. The mayor of each city and the president of each village shall file with the secretary of the State board of health, on or before the 1st day of January, 1914, a true and correct description of the entire sewage system owned by the municipality. It shall be the duty of the State board of health, on receipt of such plans and specifications, to inspect the same with reference to their effect upon the public health, and if such board on such inspection finds that such sewage systems or any parts thereof are dangerous to individuals, or to the public health generally, the said board on its order may require such alterations in such systems as may be required or advisable in the opinion of such board: *Provided*, That nothing herein contained shall be construed to grant any power to prevent any municipality now disposing of its sewage into any river from continuing so to do. Such recommendations or orders shall be served in writing upon the clerk of the city or village, and thereupon it shall be the duty of such

city or village to make such alterations, changes, or additions to its sewage system as shall have been so recommended or ordered by said board. Such orders may be reviewed or enforced by any court of chancery or other court having jurisdiction.

SEC. 12. *State board to employ sanitary engineer.*—The State board of health is hereby authorized and empowered to employ a sanitary engineer, who shall be known by the title of State sanitary engineer, who shall give his full time, under the direction of the State board of health, to the visitation, inspection, and investigation of the waterworks systems, sewage-disposal systems, garbage-disposal systems in the cities and villages of this State, and to such other matters as the State board of health may direct. He shall be paid a salary of a sum not to exceed $3,000 per annum, and his expenses for traveling and clerk hire, under the direction of the State board of health, to be paid out of the general fund of the State, the same to be audited as provided by law on the approval of the secretary of the State board of health. He shall at all times be subject to the orders of and removal by the State board of health.

MINNESOTA.

[GENERAL STATUTES, 1913.]

1268. *Village council to prevent fouling of waters.*—The village council shall * * * have power to adopt, amend, or repeal all such ordinances, rules, and by-laws as it shall deem expedient for the following purposes: * * * (17) Board of health, etc.: To establish a board of health, with all the powers of such boards under the general laws; * * * to provide for the cleaning and removal of obstructions from any river, stream, lake, slough, or water-course within the village; and to prevent the obstruction or retarding of the flow of waters therein, or the fouling of the same.

1545. *City council to prevent contamination of waters.*—The city council shall have power and it shall be its duty after the construction of such works [waterworks] to maintain the same and to prevent injury or obstruction to the channel or works and contamination of the waters. And for such purposes the city council may enact suitable ordinances and prescribe penalties for their violation, not exceeding a fine of $100 for each offense, or confinement in the city workhouse not exceeding 90 days. The municipal court of the city shall have jurisdiction of such offenses.

4640. *State board of health to enforce regulations to prevent pollution of streams.*—The board [State board of health] may adopt, alter, and enforce reasonable regulations of permanent application throughout the whole or any portion of the State, or for specified periods in parts thereof, for the preservation of the public health. Upon the approval of the attorney general and the due publication thereof, such regulations shall have the force of law, except in so far as they may conflict with a statute or with the charter or ordinances of a city of the first class upon the same subject. In and by the same the board may control, by requiring the taking out of licenses or permits, or by other appropriate means, any of the following matters: * * * (5) The pollution of streams and other waters, and the distribution of water by private persons for drinking or domestic use.

4670. *Pollution of water.*—No sewage or other matter that will impair the healthfulness of water shall be deposited where it will fall or drain into any pond or stream used as a source of water supply for domestic use. The State board of health shall have general charge of all springs, wells, ponds, and streams so used, and shall take all necessary and proper steps to preserve

the same from such pollution as may endanger the public health. In case of violation of any of the provisions of this section the State board may, with or without a hearing, order any person to desist from causing such pollution and to comply with such direction of the board as it may deem proper and expedient in the premises. Such order shall be served forthwith upon the person found to have violated such provisions.

4671. *Appeal to district court.*—Within five days after service of such order, any person aggrieved thereby may appeal to the district court of the county in which such polluted source of water supply is situated; and such appeal shall be taken, prosecuted, and determined in the same manner as provided in section 4668. During the pendency of such appeal, the pollution against which the order has been issued shall not be continued, and upon violation of such order the appeal shall forthwith be dismissed.

4773. *Sawdust deposits.*—Any person who deposits any sawdust or other refuse in any streams or water wherein the commission [State game and fish commission] has deposited fish fry, or may deposit any such fry, or where any brook trout naturally abound, shall be deemed guilty of a misdemeanor.

4865. *Poisoning water supplies to kill fish.*—No person shall lay, set, use, or prepare any drug, poison, lime, medicated bait, nets, fish berries, * * * or any other deleterious substance whatever, * * * in any of the waters in this State with intent to thereby or therewith catch, take, or kill any fish.

8482. *Punishment of misdemeanors when not fixed by statute.*—Whoever is convicted of a misdemeanor for which no punishment is prescribed by any statute in force at the time of conviction and sentence shall be punished by imprisonment in the county jail for not more than three months, or by a fine of not more than $100.

8483. *Punishment of gross misdemeanor when not fixed by statute.*—Whoever shall be convicted of a gross misdemeanor for which no punishment is prescribed by any statute in force at the time of conviction and sentence shall be punished by imprisonment in the county jail for not more than one year, or by a fine of not more than $1,000.

8782. *Throwing offal, dead bodies, etc., into streams.*—Every person * * * who shall deposit or cast into any lake, creek, or river wholly or partly in the State, or shall deposit upon the ice of any such lake, creek, or river, the offal from, or the dead body of, any animal, shall be guilty of a gross misdemeanor, and punished by a fine of not less than $100, or imprisonment in the county jail for not less than three nor more than six months.

8787. *Waterworks must not be in filthy condition.*—Every owner, agent, manager, operator, or anyone having charge of any waterworks furnishing water for public or private use who knowingly permits the appliances of the same to become in a filthy condition, or in such condition that the purity and healthfulness of the water supplied by reason thereof becomes impaired, shall be guilty of a felony, and punished by imprisonment in the State prison for not more than 10 years.

9007. *Poisoning water supplies.*— * * * every person who shall willfully poison any spring, well, or reservoir of water, shall be punished by imprisonment in the State prison for not more than 10 years, or by a fine of not more than $500, or by both.

MISSISSIPPI.

[CODE OF 1906.]

1329. *Poisoning water supplies to kill fish.*—Every person who shall poison any fish by mingling in the water any substance calculated and intended to

stupefy or destroy fish shall be guilty of a misdemeanor, and, on conviction, shall be fined not less than $5 or imprisoned in the county jail not less than 10 days, or both.

1331. *Poisoning water supplies with intent to injure.*—Every person * * * who shall willfully poison any well, spring, or reservoir of water, shall, upon conviction, be punished by imprisonment in the penitentiary not exceeding 10 years, or in the county jail not exceeding one year, or by fine not exceeding $1,000, or both.

1397. *Pollution of public-water supplies.*— * * * if any person shall pollute any such waters [navigable waters] by putting therein the carcass of any dead animal, or any refuse or foul matter, or any matter or thing calculated to render the water thereof less fit for drink, or the sustenance of fish, the person so offending, in either case, shall be guilty of a misdemeanor, and, on conviction, shall be punished by a fine of not more than $50 or by imprisonment in the county jail not more than 30 days, or both. But this section shall not be so construed as to prevent any city or town in this State from constructing sewers so as to empty into any navigable streams of water of this State.

2489. *Regulations of State board of health.*—The State board of health is authorized to make and publish all reasonable rules and regulations necessary to enable it to discharge its duties and powers and to carry out the purposes and objects of its creation, and reasonable sanitary rules and regulations to be enforced in the several counties by the county health officer under the supervision and control of the State board of health.

3286. *Befouling water supplies with wood working refuse.*—The owners of mills, factories, gins and the like shall not throw any sawdust or other refuse in the watercourse, or leave the same where it might run or be carried into any lake, pond, or watercourse by the rains or high water, and thus injure the water for use and sustenance of fish. And every such owner, his agents and servants, so offending, by omission or commission, shall be liable to any person damaged thereby; and every person who is entitled to fishing privilege in any such water so injured shall be entitled to damages.

[PRIVIES, CESSPOOLS, AND PUBLIC TOILETS. REG BD. OF H., JUNE 2, 1913.]

SEC. 3. No privy shall be maintained in any room, nor shall it have direct connection with any room wherein any kind of exposed food or foodstuff is stored, prepared, or handled.

SEC. 4. All privies located in or near public buildings such as courthouses, depots, hotels, and schoolhouses must be well lighted and ventilated and kept in a sanitary condition at all times.

SEC. 5. No insanitary privy shall be maintained by any person near to a dairy, meat market, bakery, grocery store, or other place where food is stored, prepared, or handled. This has reference to such food as can be contaminated.

SEC. 6. No person shall misuse or abuse any public toilet of any depot, schoolhouse, hotel, or other public building or railway coach, either by writing upon the walls or by interfering with the plumbing of said toilets by throwing therein trash of any kind or otherwise.

[PRIVY VAULTS AND CESSPOOLS. REG. BD. OF H., AUG. 17, 1914.]

SECTION 1. No privy pit, cesspool, or reservoir into which any privy, watercloset, stable, sink, or other receptacle of refuse or sewerage is drained shall be constructed or maintained in any situation or in any manner whereby, through leak or overflow of its contents, it may cause pollution of any well, spring, or

other source of water used for drinking or culinary purposes; nor shall the overflow from any such reservoir or receptacle be permitted to discharge into any public place or in anywise whereby danger to health may be caused. And every such pit, reservoir, or receptacle shall be cleaned and the contents thereof removed at such times and under such precautions as the State board of health may prescribe. * * *

SEC. 3. No person, firm, or corporation shall own, maintain, or rent any privy in any incorporated or unincorporated city, town, or village, unless the same shall be so constructed as to prevent the soil from contamination; * * *.

SEC. 14. No privy, vault, water-closet, cesspool, stable drain, or sink shall open into any ditch, stream, or drain, except into the public sewers of any city or into disposal tanks properly designed for such purpose.

SEC. 15. All sewer drains leading out to vaults or disposal plants shall be of standard construction, and no sewer drain or outlet from any sewage-disposal plant shall empty into any lake, pond, creek, stream, or open field unless all possible provision is made to prevent the contamination of any water supply. Nor shall any such drain or outlet be allowed to become obnoxious or dangerous to public health.

SEC. 16. No pit privy shall be constructed within 200 feet of a well or spring. Furthermore, it shall always be located so that the drainage from the privy will be away from the water supply and in such a position as to avoid overflow of its contents either by seepage water or surface drainage.

SEC. 17. No pit closet shall be constructed wherever there is a gravel bed or a distinctly limestone formation permitting free circulation of underground water, but such a closet can be used wherever there is a compact soil.

SEC. 19. No abandoned well or deep well shall be used for sewage disposal or a receptacle for household waste.

MISSOURI.

[REVISED STATUTES, 1909.]

4486. *Prohibiting poisoning water supplies.*—Every person * * * who shall willfully poison any spring, well, or reservoir of water shall, upon conviction, be punished by imprisonment in the penitentiary not exceeding five years.

4615. *Prohibiting pollution of school water supplies.*—Every person * * * who shall in any manner pollute the water contained in any well, cistern, or reservoir [connected with any building used for schoolhouse or church purposes] shall be deemed guilty of a misdemeanor.

4795. *Disposal of carcasses.*—If any person or persons shall put any dead animal, carcass, or part thereof, the offal, or any other filth into any well, spring, brook, branch, creek, pond, or lake, every person so offending shall, on conviction thereof, be fined in any sum not less than $10 nor more than $100. If any person shall remove or cause to be removed and placed * * * in any of the streams or watercourses other than the Missouri or Mississippi River any dead animal, carcass, or part thereof, or other nuisance to the annoyance of the citizens of this State, or any of them, every person so offending shall, upon conviction thereof, be fined for every such offense any sum not less than $10 nor more than $50, and if such nuisance be not removed within three days thereafter, it shall be deemed a second offense against the provisions of this section.

4796. *Prohibiting poisoning water supplies.*—Whoever willfully or maliciously poisons, defiles, or in any way corrupts the water of a well, spring, brook, or

reservoir used for domestic or municipal purposes * * * shall be adjudged guilty of a misdemeanor and punished by a fine not less than $50 nor more than $500, or by imprisonment in the county jail not exceeding one year, or by both such fine and imprisonment, and shall be liable to the party injured for three times the actual damage sustained, to be recovered by suit at law.

6536 (as amended by Laws, 1915, p. 292). *Prohibiting deposition in watercourses of materials harmful to fish.*—It shall be unlawful for any person or persons, firm, or corporation to cause any dyestuff, coal tar, oil, sawdust, poison, or deleterious substances to be thrown, run, or drained into any of the waters of this State in quantities sufficient to injure, stupefy, or kill fish which may inhabit the same at or below the point where any such substances are discharged or caused to flow or be thrown into such waters: *Provided*, That it shall not be any violation of this section for any person, firm, or corporation engaged in any mining industry to cause any water handled or used in any branch of such industry to be discharged on the surface of the land where such industry or branch thereof is being carried on under such precautionary measures as shall be approved by the State game and fish commissioner. Any person or persons, firm, or corporation offending against any of the provisions of this section shall be deemed guilty of a misdemeanor, and, upon conviction, shall be fined not less than $200 nor more than $500 for each offense.

6538 (as amended by Laws of 1915, p. 293). *Poison not to be used to kill fish.*—No person shall place or use in any of the waters of this State any medical drug, any cocculus indicus, or fish berry, or any other poisonous thing or substance calculated to poison, kill, or injure any fish, nor shall by such means kill, catch, or take any fish that may be in said waters * * *. Any person who shall violate any of the provisions of this section shall on conviction be adjudged guilty of a felony and punished by imprisonment in the penitentiary for a term not exceeding two years, or by imprisonment in the county jail not less than 30 days, or by fine not less than $100, or by both such fine and imprisonment.

6563. *Certain articles forfeited to State.*—The unlawful use of any articles contrary to the provisions of the game and fish law shall forfeit the same to the State, and upon their being found by law under any of the conditions prohibited by this article [secs. 6536 and 6538 are included in the article] shall be destroyed.

8890[1] (as amended by Laws, 1917, p. 365). Every city of the second class [cities with 30,000 and less than 100,000 inhabitants] shall have power by ordinance not inconsistent with the constitution or any law of this State or of this article [art. 84, Rev. Stats., 1909, as amended]. Thirty-sixth. To provide water, etc.: To provide the city and its inhabitants with water; to prevent the water supply of the city from becoming polluted or contaminated, and for this purpose such city shall have jurisdiction as far beyond the limits as is necessary.

9559. *Cities may inspect sources of water sold to public, etc.*—All cities in this State have power and authority to regulate and license and to levy and collect license tax on all springs, wells, or other sources of water supply from which water is sold to the public or offered or shipped for sale and to inspect the same and analyze such waters.

9560. *Cities may protect water supplies.*—Such cities shall have the power and authority by ordinance to provide for the protection of all springs, wells,

[1] This section number of the Revised Statutes, 1909, is not given in the law of 1917 here referred to, which repeals sec. 8890, among others, and enacts new legislation in its place; but it has seemed more convenient to retain the section number for this compilation.

or other sources of water supply described in section 9559 from contamination or danger of contamination.

MONTANA.

[REVISED CODES OF 1907, SUPPLEMENT OF 1915.[1]]

1477. *Power of State board of health to make and enforce regulations.*—The State board of health shall have power to promulgate and enforce such rules and regulations for the better preservation of the public health in contagious and epidemic diseases as it shall deem necessary, and also regarding the causes and prevention of diseases, and their development and spread; and if any person or corporation refuses, after notice in writing from the secretary of the State board of health, or from any local or county board of health, of such rules and regulations, to comply therewith, within a reasonable time, he shall be guilty of a misdemeanor and, upon conviction thereof, shall be fined in a sum not less than $10 nor more than $100, with costs of prosecution; and it shall be the duty of the secretary of the State board of health to prepare and distribute to local boards of health, physicians, and other persons requesting them, such printed circulars as the board may direct, and such rules and regulations as the board may promulgate as aforesaid. (Revised Codes of 1907.)

1488. *Penalties for failure to comply with orders of State board of health.*—If any person or corporation shall neglect or refuse to comply with any written order of a local, county, or State health officer, made and promulgated by either of them under this act, within a reasonable time, to be designated in the notice, such person or corporation shall be guilty of a misdemeanor. In case of such neglect or refusal to comply with such order, the local, county, or State board of health may cause it to be complied with at the expense of the town, city, or county, and such expenses shall be recovered from the person or corporation whose legal duty it was to comply with such order, by a civil action brought in the name of such town, city, or county. (Revised Codes of 1907.)

1508. *Putting dead animals into streams, etc.*—If any person or persons shall put any dead animal, or part of the carcass of any deal animal into any lake, river, creek, pond, reservoir, * * * or who being the owner shall knowingly permit the same to remain in any of the aforesaid places to the injury of the health, or to the annoyance of the citizens of this State, or any of them, every person so offending shall be guilty of a misdemeanor, and every 24 hours that said person shall permit the same to remain shall be deemed an additional offense under the provisions of this act. (Revised Codes of 1907.)

1509. *Approval of State board of health required for sewer construction.*—Whenever any city, town, or corporation, or person shall hereafter contemplate the construction of any sewer system that will empty into any stream or source of water supply in this State, they shall submit a plan of such proposed system to the State board of health and said board shall cause a thorough investigation to be made, and if after such an investigation they shall determine that such sewerage [sic] will so pollute the waters of any stream or source of water supply as to endanger the health or lives of the citizens of this State, or any of them, they shall submit to the judge of the district court of the district in which such proposed sewerage system is located the evidence on which their findings are based, and if said judge, upon that evidence and such other evidence as the judge may receive on a hearing at which all parties in interest may be heard and present evidence if they desire, shall find that the action of the State board of health is just and unbiased he

[1] Whether the law is taken from the Revised Codes or from the Supplement is indicated in parenthesis at the end of each section.

shall issue an order preventing the construction of such sewerage system except under such conditions as the State board of health may designate.

A city or town may appeal to the district court of the county in which such city or town may be located from any order of the State board of health affecting such city or town at any time within 30 days after the service on the city or town council of such order. Such appeal may be taken by filing notice thereof in such court either before or after serving a copy of such notice on any member of the State board of health. The court may order pleadings to be filed to present the issues and such case shall be tried de novo the same as appeal from a justice court. (Supplement of 1915.)

1559. *State board of health to have control of public water supply.*—The State board of health shall have the general oversight and care of all inland waters and of all streams, lakes, and ponds used by any city, town, or public institution or by any water or ice company in this State as sources of water supply for domestic use, and of all springs, streams, and water courses tributary thereto. It shall be provided with maps, plans, and documents suitable for such purposes, and shall keep records of all its transactions relative thereto. (Revised Codes of 1907.)

1560. *Examinations of waters.*—Said State board of health may cause examination of waters to be made to ascertain their purity and fitness for domestic use or their liability to impair the interests of the public or of persons lawfully using them or to imperil the public health. It may make rules and regulations to prevent pollution and to secure the sanitary protection of all such waters as are used for domestic purposes. (Revised Codes of 1907.)

1561. *Publications of orders, rules, and regulations.*—The publication of an order, rule, or regulation made by the State board of health under the provisions of this act [secs. 1559–1572] in a newspaper of the city or town in which such order, rule, or regulation is to take effect, or, if no newspaper is published in such city or town, the posting of a copy of such order, rule, or regulation in a public place in such city or town shall be legal notice to all persons, and an affidavit of such publication or posting by the person causing such notice to be published or posted, filed and recorded, with a copy of the notice, in the office of the clerk of such city or town shall be admitted as evidence of the time at which, and the place and manner in which, the notice was given. (Revised Codes of 1907.)

1562. *Employment of agents and servants.*—Said State board of health may appoint, employ, and fix the compensation of such agents, clerks, servants, engineers and expert assistants as it considers necessary. Such agents and servants shall cause the provisions of law relative to the pollution of water and of the rules and regulations of said board to be enforced. (Revised Codes of 1907.)

1563. *Duties of the board.*—Said board shall consult with and advise the authorities of cities and towns and persons having or about to have systems of water supply, drainage, and sewerage as to the most appropriate source of water supply and the best method of assuring its purity or as to the best method of disposing of their drainage or sewage with reference to the existing and future needs of other cities, towns, or persons which may be affected thereby. It shall also consult with and advise all corporations, companies, or persons engaged or intending to engage in any manufacturing or other business whose drainage or sewage may tend to pollute any inland water as to the best method of preventing such pollution, and it may conduct experiments to determine the best methods of the purification or disposal of drainage or sewage. Cities, towns, and all other corporations, companies, or persons shall submit to said board for its advice and approval their proposed system of water supply or of the disposal of drainage or sewage, and no city, town, or persons, or company shall proceed

to build or install or enlarge or extend any system of water supply, drainage or sewage disposal, without first obtaining the approval of the State board of health. In this section, the term "drainage" means rainfall, surface, and subsoil water only, and "sewage" means domestic and manufacturing filth and waste. (Revised Codes of 1907.)

1564 (as amended by acts, 1917, chap. 26). *Prohibiting pollution of water supplies.*—No sewerage [sic], drainage, refuse, or polluting matter, of[1] such kind and amount as either, of itself or in connection with other matter, will corrupt, pollute, or impair the quality of the water of any spring, pond, lake, or stream used as a source of water or ice supply by a city, town, or Federal, State, or county institution, or water or ice company for domestic use, or render it injurious to health, and no human excrement shall be discharged into any such stream, spring, lake, pond, or upon their banks or into any feeders of such spring, lake, pond, or stream unless such sewerage [sic], drainage, refuse, or polluting matter shall at the discretion of the State board of health have been purified, so as to render it harmless in such a manner and under such conditions and restrictions as the State board of health may direct.

1565. *Protection of watersheds.*—No municipal or other public or private corporation and no company or person shall hereafter construct, build, establish, or operate any railroad, logging road, logging camp, electric plant, or manufacturing plant of any kind upon or over any watershed of any public water supply system, unless such corporation, company, or person shall protect said water supply from pollution by such sanitary precautions as shall be approved by the State board of health, and any such corporation, company, or person intending to construct, build, or establish, or operate any railroad, logging road, logging camp, electric plant, or manufacturing plant of any kind upon the watershed of any public water supply system, shall furnish the State board of health with detailed plans and specifications of the sanitary precautions to be taken, which must be approved by said board. (Revised Codes of 1907.)

1566. *Complaints and investigations.*—Upon complaint to the State board of health of the mayor or health officer of any city or town or the managing board or officer of any public institution or the president of an ice company stating that manure, excrement, garbage, sewage, or any other matter which pollutes or tends to pollute the waters of any lake, pond, spring, stream, or watercourse used by such city or town, public institution or company as a source of water supply, the said board shall cause a thorough investigation to be made of such alleged nuisance or pollution, and if, in its judgment, the public health so requires, shall by order served upon the party causing or permitting such pollution, prohibit the continuance of such pollution and shall order him to remove any such cause of pollution. (Revised Codes of 1907.)

1567. *Agents and servants of boards may enter buildings.*—The agents and servants of said board may enter any building, structure, or premises for the purpose of ascertaining whether sources of pollution or danger to the water supply there exist, and whether the rules, regulations, and orders aforesaid are obeyed. (Revised Codes of 1907.)

1568. *Appeals to the district court from orders of the State board of health.*—Whoever is aggrieved by any order of the State board of health passed under the provisions of this act may appeal therefrom to the district court of the county in which such order shall be effective. But such notice as the court shall order shall also be given to the mayor of the city or town or president of the water company or any other persons interested in such order. While the appeal is pending the order of the State board of health shall be complied with

[1] Text reads "or."

unless otherwise authorized by the State board of health. (Revised Codes of 1907.)

1569. *Jurisdiction of the district court.*—The district court of any county of the State shall have jurisdiction in equity upon the application of the State board of health or any person interested, to enforce its orders or the orders, rules, and regulations of said board of health, and to restrain the use or occupation of the premises or such portion thereof as said board may specify, on which said material is deposited or kept, or such other cause of pollution exists, until the orders, rules, and regulations of said board have been complied with. (Revised Codes of 1907.)

1570. *Establishment of experimental stations.*—In order that the State board of health may at all times be prepared to give the best advice to cities, towns, public institutions, or private corporations relative to the prevention or removal of pollutions of water, said board is hereby authorized to establish and maintain an experimental station for the purpose of studying the best methods of preventing pollution of water and for the purification of water and for the purification, disinfection, and disposal of sewage and domestic and manufacturing waste so as to prevent pollution of water, and said board is authorized to cause sanitary methods and systems in use outside of the State of Montana to be investigated and studied with a view of ascertaining their fitness for conditions in this State. (Revised Codes of 1907.)

1571. *Biennial reports.*—The State board of health shall biennially make a report to the legislature, through the governor, of its doings for the preceding period, recommending measures for the prevention of the pollution of such waters and for the removal of polluting substances in order to protect and develop the rights and property of the State and municipalities therein and to protect the public health, and recommend any legislation or plans for systems of main sewers necessary for the preservation of the public health and for the purification and prevention of pollution of the ponds, lakes, springs, and inland waters of the State. It shall also give notice to the attorney general of any violation of law relative to the pollution of water supplies and inland waters. (Revised Codes of 1907.)

1572. *Penalties for violation of this act.*—Whoever violates any of the provisions of this act or any rule, regulation, or order of the State Board of health made under the provisions of this act shall be punished for each offense by a fine of not more than $1,000 or by imprisonment for not more than one year, or by both such fine and imprisonment. (Revised Codes of 1907.)

1985. *Deposits of foreign substances in or near streams or lakes.*—No person or corporation operating a sawmill on or near any stream, pond, lake, or river shall hereafter dump, drop, cart, or deposit, or cause to be dumped, dropped, carted, or deposited, sawdust, bark, shavings, oil, ashes, cinders, or débris in or near any such stream, pond, lake, or river, or in such manner or place as will likely result of cause the same to be carried into the waters of any such stream, pond, lake, or river; and any person so doing shall be deemed guilty of a misdemeanor and, upon conviction, punished by a fine of not less than $50 nor more than $500, or by imprisonment in the county jail not less than 30 days nor more than six months, or by both such fine and imprisonment.[1] (Supplement of 1915.)

6162. *What is nuisance.*—Anything which is injurious to health or is indecent or offensive to the senses, * * * or unlawfully obstructs the free passage or use in the customary manner of any navigable lake, river, bay, stream, canal, or basin, * * * is a nuisance. (Revised Codes of 1907.)

[1] See secs. 8797 and 8798, which are supplemented by this section.

8111. *Punishment of misdemeanor when not otherwise prescribed.*—Except in cases where a different punishment is prescribed by this code, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding six months or by a fine not exceeding $500, or both. (Revised Codes of 1907.)

8442. *Willfully poisoning water supplies.*— * * * every person who willfully poisons any well, spring, or reservoir of water is punishable by imprisonment in the State prison for a term not less than one nor more than ten years. (Revised Codes of 1907.)

8484. *Befouling watersheds.*—Every person who puts the carcass of any dead animal or the offal from any slaughter pen, corral, or butcher shop into any river, creek, pond, lake, reservoir, or stream, * * * and every person who puts the carcass of any dead animal or any offal of any kind in or upon the borders of any stream, pond, lake, or reservoir from which water is drawn for the supply of the inhabitants of any city or town in this State, so that the drainage from such carcass or offal may be taken up by or in such stream, pond, lake, or reservoir, or who allows the carcass of any dead animal or any offal of any kind to remain in or upon the borders of any such stream, pond, lake, or reservoir within the boundaries of any land owned or occupied by him, or who keeps any horses, mules, cattle, swine, sheep, or live stock of any kind, penned, corralled or housed on, over, or on the borders of any such stream, pond, lake, or reservoir so that the waters thereof shall become polluted by reason thereof is guilty of a misdemeanor and upon conviction thereof shall be punished as prescribed in section 8485 of this code. (Revised Codes of 1907.)

8485. *Penalty for violation of health laws.*—Every person who willfully violates any of the laws of this State relating to the preservation of the public health is, unless a different punishment is prescribed by this code, punishable by imprisonment in the county jail not exceeding one year or by a fine not exceeding $1,000, or both. (Revised Codes of 1907.)

8557. *Depositing coal slack in streams.*—All persons owning or having in operation, and all persons who may hereafter own or put in operation in the State of Montana, either in person or by agent, any coal mine on any stream containing fish or water which is used for domestic purposes or for irrigation, are hereby required to so care for any coal slack or other refuse emanating from such coal-mining operation as to prevent the same from mingling with the waters of such streams. (Revised Codes of 1907.)

8558. *Penalty.*—All persons owning or operating, or who may hereafter own or operate any coal mine on any stream containing fish or water which is used for domestic purposes, or for irrigation, who shall dump, cart, or deposit, or cause or suffer to be deposited in such stream any such coal slack or other refuse emanating from such coal-mining operation, shall be deemed guilty of a misdemeanor, and, upon conviction thereof before any court of competent jurisdiction, shall be fined in any sum not less than $200 nor more than $500 for each and every offense. (Revised Codes of 1907.)

8796. *Poisoning fish.*—If any person or persons shall use * * * any corrosive or narcotic poison, or other deleterious substance for the purpose of catching, stunning, or killing fish, he shall be deemed guilty of a felony and upon conviction thereof shall be punished by a fine of not less than $200 nor more than $500, or by imprisonment in the State prison not less than one year nor more than three years, or both such fine and imprisonment. (Supplement of 1915.)

8797. *Depositing sawdust in streams.*—Every person who operates any sawmill on or near any stream, who dumps, drops, carts, deposits, or causes to be deposited in any such stream, any sawdust, bark, or débris, coming from

said sawmill, is punishable by a fine not less than $50 nor more than $250, or by imprisonment in the county jail not less than 30 days nor more than 90 days, or both such fine and imprisonment, in the discretion of the court.[1] (Revised Codes of 1907.)

8798. *Putting sawdust, chemicals, or débris in streams.*—Every person who operates any sawmill, pulp mill, paper mill, or wood-manufacturing plant on or near any stream, lake, or any body of water connected with any stream or lake, who dumps, drops, carts, deposits, or causes to be deposited in such stream, lake, or body of water connected with any stream or lake, any sawdust, bark, chemicals, refuse, or débris coming from said sawmill, pulp mill, paper mill, or wood-manufacturing plant, is punishable by a fine not exceeding $500.[1] (Revised Codes of 1907.)

[SANITARY REGULATIONS FOR CAMPS. REG. BD. OF H., APR. 8, 1913.]

REG. 15. Hereafter contractors and all other persons who may establish an industrial camp or camps, for the purpose of logging or any like industry, or for the purpose of construction of any road, railroad, or irrigation canal, or other work requiring the maintenance of camps for men engaged in such work, or any other temporary or permanent industrial camp of whatsoever nature, shall report to the State health official concerning the location of such camp or camps, and shall arrange such camp or camps in a manner approved by the State health official so as to maintain good sanitary conditions, and shall at all times keep such camp or camps in a sanitary condition satisfactory to the State health official.

REG. 20. The use of the toilets provided for the men should be made obligatory, and instant discharge of any employees polluting the soil must be rigidly enforced to make such rules effective.

REG. 31. The supply of water for the camp should be carefully decided upon, and wherever possible, if the camp is to remain several weeks, it is well to run it in pipes from an absolutely uncontaminated source.

NEBRASKA.

[REVISED STATUTES, 1913.]

2672. *Poisoning fish prohibited.*—Whoever * * * shall place any * * * poisonous or stupefying substance in any water containing fish, shall be fined not less than $100 nor more than $500 or be imprisoned in the penitentiary not exceeding one year.

2691. *Confiscation of poison.*—Every * * * poisonous or stupefying substance or device used or intended for use in taking or killing * * * fish in violation of this chapter [sec. 2672], is hereby declared to be a public nuisance and may be abated and summarily destroyed by any person, and it shall be the duty of every such officer authorized to enforce this chapter to seize and summarily destroy the same, and no prosecution or suit shall be maintained for such destruction * * *.

2738. *State board of health regulations.*—The State board of health shall have supervision and control of all matters relating to sanitation and quarantine necessary to the protection of the people of this State from disease arising from insanitary conditions and from contagious, infectious, and epidemic diseases; and it shall be the duty of said State board of health to formulate, adopt, and publish such proper and reasonable general rules and regulations

[1] See sec. 1985, which supplements secs. 8797 and 8798. The three sections overlap.

as will best serve to promote sanitation throughout the State and prevent the introduction or spread of disease. * * * It shall be the duty of all local, municipal and county boards of health, health authorities and officials, officers of State institutions, police officers, sheriffs, constables, and all other officers and employees of the State, or of any county, city, village, or township thereof, and every person to obey and enforce such quarantine and sanitary rules and regulations as may be adopted by the State board of health; and each and every person or officer specified in this section who shall fail, neglect, or refuse to obey or enforce such rules or regulations shall, upon conviction, for each and every such offense, be subject to a fine of not less than $15 nor more than $100.

8841. *Putting carcass into springs, etc., used for domestic purposes.*—Whoever shall put any dead animal, carcass, or part thereof, or other filthy substance, into any well or into any spring, brook, or branch of running water, of which use is made for domestic purposes shall be fined in any sum not less than $2 nor more than $40.

8842. *Putting carcass or offal into rivers, etc.*—Whoever shall put the carcass of any dead animal, or the offals from any slaughterhouse or butcher's establishment, packing house, or fish house, or any spoiled meats or spoiled fish, or any putrid animal substance, or the contents of any privy vault, upon or into any river, bay, creek, pond, canal * * * shall be fined in any sum not less than $1 nor more than $50.

8845. *Nuisances, penalty, definition.*—Whoever shall erect, keep up, or continue and maintain any nuisance, to the injury of any part of the citizens of this State shall be fined in any sum not exceeding $500, and the court shall, moreover, in case of conviction of such offense, order every such nuisance to be abated or removed. * * * The corrupting or rendering unwholesome or impure any water course, stream, or water * * * shall be deemed nuisances; and every person or persons guilty of erecting, continuing, using, or maintaining, or causing any such nuisances shall be guilty of a violation of this section, and in every such case the offense shall be construed and held to have been committed in any county whose inhabitants are or have been injured or aggrieved thereby.

NEVADA.

[REVISED LAWS, 1912.]

794. *Power of city council to prevent pollution of water supplies.*—The city council shall have the following powers:

39. To construct or authorize the construction of waterworks without the city limits for the supply of said city, and for the purpose of maintaining and protecting the same from injury and the water from pollution, their jurisdiction shall extend over the territory occupied by such works and over all reservoirs, streams, canals, ditches, pipes, flumes, and drains used in or necessary for the construction, maintenance, and operation of the same, and over the stream or source from which the water is taken, above the point from which it is taken, and to enact all ordinances and regulations necessary to carry the power herein conferred into effect.

4716. *County commissioners may institute suit to prevent pollution of streams.*—The board of county commissioners of any county in this State are hereby authorized and empowered to institute and maintain suit in any court of competent jurisdiction against any persons, firms, association, or corporation depositing sawdust in any river or stream the waters of which run partly or wholly in this State.

4717. *Tax may be levied for enforcement of section 4716.*—The boards of county commissioners of any and all counties of this State are hereby authorized and empowered to levy annually such tax as in their discretion may be necessary to carry out the provisions of this act [sec. 4716].

4718. *Pollution of streams by sawmills, etc., unlawful.*—It shall be and is hereby declared unlawful for any person or persons being the owner or owners of or being in possession of any sawmill or mills used for the making of lumber, or the owner or owners of any slaughterhouse, brewery, or tannery, to injure or obstruct the natural flow of water in any river, creek, or other stream, or to permit any sawdust, chips, shavings, slabs, offal, refuse, tan bark, or other offensive matter to enter therein so as to damage or corrupt the purity of the water of such stream or streams.

4719. *Action for damages.*—Any city or county government, or any person or persons, being the owner or owners of or in the possession of any agricultural lands, who may be injured by reason of the violation on the part of any person or persons of the provisions contained in the preceding section, shall have the right to commence and maintain an action against such person or persons for any damage sustained, in such manner as may be provided by law.

4720. *Penalty.*—Any person who shall willfully and knowingly violate the provisions of this act [secs. 4718–4720] shall be guilty of a misdemeanor and may be punished by a fine not exceeding $500.

6285. *Punishment of misdemeanor when not fixed by statute.*—Every person convicted of a misdemeanor for which no punishment is prescribed by any statute in force at the time of conviction and sentence, shall be punished by imprisonment in the county jail for not more than six months, or by a fine of not more than $500, or by both.

6286. *Misdemeanor by corporations.*—In all cases where a corporation is convicted of an offense for the commission of which a natural person would be punishable as for a misdemeanor, and there is no other punishment prescribed by law, such corporation is punishable by a fine not exceeding $500.

6540. *Furnishing impure water a gross misdemeanor.*—Every owner, agent, manager, operator, or other person having charge of any waterworks furnishing water for public or private use, who shall knowingly permit any act or omit any duty or precaution by reason whereof the purity or healthfulness of the water supplied shall become impaired, shall be guilty of a gross misdemeanor.

6541. *Penalty for poisoning springs, etc.*— * * * every person who shall willfully poison any spring, well, or reservoir of water shall be punished by imprisonment in the State prison for not less than five years.

6546. *Throwing dead animals or offal into rivers, etc.*—Every person who shall deposit, leave, or keep on or near a highway or route of public travel, on land or water, any unwholesome substance; or who shall establish, maintain, or carry on, upon or near a highway or route of public travel, on land or water, any business, trade, or manufacture which is detrimental to the public health; or who shall deposit or cast into any lake, creek, or river, wholly or partly in this State, the offal from or the dead body of any animal, shall be guilty of a gross misdemeanor.

6561. *Befouling of streams a nuisance.*—A public nuisance is a crime against the order and economy of the State. * * * Every act unlawfully done and every omission to perform a duty, which act or ommission * * * (3) shall unlawfully interfere with, befoul * * * a lake, navigable river, bay, stream, canal, ditch, mill race, or basin * * * shall be a public nuisance.

6563. *Maintaining or permitting nuisance.*—Every person who shall commit or maintain a public nuisance for which no special punishment is prescribed,

or who shall willfully omit or refuse to perform any legal duty relating to the removal of such nuisance, and every person who shall let or permit to be used any building or boat or portion thereof knowing that it is intended to be, or is being used for committing or maintaining any such nuisance, shall be guilty of a misdemeanor.

6564. *Abatement of nuisance.*—Any court or magistrate before whom there may be pending any proceeding for a violation of the next preceding section shall, in addition to any fine or other punishment which it may impose for such violation, order such nuisance abated, and all property unlawfully used in the maintenance thereof destroyed by the sheriff at the cost of the defendant.

[LAWS 1917, CHAP. 49.]

SECTION 1. *Suits to be brought to prevent pollution of streams.*—It shall be the duty of the attorney general, with the consent of the governor, to commence such action or actions, suit or suits, against any and all persons, municipalities, towns, cities, corporations, or associations, as may be necessary to prevent or restrain the pollution of any public stream or streams of the State of Nevada, or any public stream or streams running in, into, or through the State of Nevada, whether the source of pollution be within or without the State of Nevada.

SEC. 2. *Attorney general to institute proceedings.*—The attorney general is authorized, empowered, and directed, with the consent of the governor, to take such proceedings and commence and maintain such action or actions, suit or suits, as may be necessary or proper to prevent or restrain the pollution of any public stream or streams in the State of Nevada, or any public stream or streams running into, in, or through the State of Nevada, and to maintain and prosecute such action or actions, suit or suits, in the name of the State of Nevada, whether the source of pollution be within or without the State of Nevada.

SEC. 3. *Appropriation.*—For the purpose of carrying out the provisions of this act there is hereby appropriated, from the general fund of the State of Nevada, the sum of $10,000: *Provided*, That not more than $1,000 of this amount be expended for attorney fees.

SEC. 4. *Appointment of committee of legislature.*—Within 10 days after the passage and approval of this act, the president of the senate shall appoint one member of the senate and the speaker of the assembly shall appoint one member of the assembly, who shall constitute a committee of the legislature for the purposes hereinafter mentioned; they shall continue to exercise the duties of such committee until 10 days after the convening of the next regular session of the legislature, within which 10 days their successors shall be appointed in the same manner and the committee shall be perpetuated indefinitely in the same manner. Any vacancy in the committee which may occur from any cause, including failure of the proper officer to appoint, shall be filled by the governor.

SEC. 5. *Committee to act in advisory capacity.*—The committee hereby created, together with the governor and attorney general, shall constitute an advisory board for the purpose of carrying out this act, which board shall have power to select, employ, and fix the compensation of such legal assistants, experts, chemists, stenographers, and other assistants to the attorney general and to authorize such other expenses as they deem necessary and proper to carry out the provisions of this act.

[LAWS 1917, CHAP. 221.]

SECTION 1. *Pollution of streams a misdemeanor.*—Any person or persons, firm, company, corporation, or association, city or town who shall deposit, or who shall permit or allow any person or persons in their employ or under their control, management, or direction to deposit in any of the waters of the lakes, rivers, streams, and ditches in or running into or through the State of Nevada, or cause to be washed or infiltered into any of said waters, or place or deposit where the same may be washed or infiltered into any of said waters, any sawdust, pulp, oils, rubbish, filth, or poisonous or deleterious substance or substances which affects the health of persons, fish, or live stock, or renders said waters unpalatable or distasteful, shall be deemed guilty of a misdemeanor and upon conviction thereof in any court of competent jurisdiction shall be fined in a sum not less than $50, nor more than $500, exclusive of court costs.

[LAWS OF 1917, CHAP. 239.]

SEC. 12. *Unlawful to pollute streams.*—Every person who places or allows to pass or who places where it can pass or fall into or upon any of the waters of this State at any time, any lime, gas, tar, cocculus indicus, slag, acids, or other chemical, sawdust, shavings, slabs, edgings, mill or factory refuse, or any substance deleterious to fish, shall be deemed guilty of a misdemeanor and on conviction thereof shall be punished by a fine not less than $250 nor more than $500, or by imprisonment in the county jail in the county in which the conviction shall be had for not less than 125 or more than 250 days: *Provided*, That the provisions of this section shall not apply to mills or works for the reduction of ores nor against the owners or operators of such mills or works so far as concerns the owners or operators of such mills or works.[1]

NEW HAMPSHIRE.

[REVISED STATUTES OF 1892, CHAP. 108.]

1. *Health officers to make regulations.*—The health officers of towns may make regulations for the prevention and removal of nuisances, and such other regulations relating to the public health as in their judgment the health and safety of the people require, which shall take effect when approved by the selectmen, recorded by the town clerk, and published in some newspaper printed in the town, or copies thereof have been posted in two or more public places in the town. Any person willfully violating such regulations shall be punished by a fine of $10 for each offense.

2. *State board of health may make regulations for local boards.*—The State board of health may make, in addition to the rules and regulations of the health officers of towns, such other rules and regulations, or such amendments to existing rules and regulations, as in their judgment the public good requires, and such rules and regulations shall be enforced by the health officers of towns in the same manner as other health regulations.

13. *Penalty for leaving offensive matter near water supply.*—If a person shall place, leave, or cause to be placed or left in or near a lake, pond, reservoir, or stream tributary thereto, from which the water supply for domestic purposes of a city, town, or village is taken, in whole or in part, any substance or fluid that may cause the water thereof to become impure or unfit for such

[1] Sec. 2047 of Revised Laws supplanted by this section.

purposes, he shall be fined not exceeding $20 or be imprisoned not exceeding 30 days, or both.

14. *How offensive matter may be removed.*—The board of health of the town or the water commissioners having charge of the water supply, or the proprietors thereof, may remove such substance or fluid; and they may recover the expense of removal from the person who placed the same or caused it to be placed in or near the water as aforesaid, in an action on the case.

17. *Analysis of water provided.*—Whenever any well, spring, or other water supply is suspected of being polluted by sewage or other matter dangerous to health, the health officers of the town where it is located may cause an analysis of its water to be made by a competent chemist, without expense to the owner. If the analysis shows the water to be unfit for drinking purposes, they may, with the approval of the State board of health, prohibit its use, and, if it be from a well, may cause the well to be closed. The State board of health shall authorize such investigations whenever deemed necessary for the public good.

[REVISED STATUTES, 1892, CHAP. 120.]

7 (as amended by Laws of 1911, chap. 153). *Filth not to be thrown into harbor.*—If any person shall unload, cast, or throw out of any ship, vessel, or boat, or from shore or wharf, any ballast, rubbish, gravel, earth, dirt, ashes, or filth into the harbor, or river of Piscataqua, between the lighthouse at the entrance of said harbor and Dover Point Bridge, so called, up said river, or aid and assist therein, he shall forfeit a sum not more than $10.

[REVISED STATUTES, 1892, CHAP. 266.]

22. *Malicious injuries to ice.*—If any person shall willfully and maliciously cut, injure, or destroy ice upon any waters within the State from which ice is taken as an article of merchandise, whereby the taking thereof is hindered, or its value diminished for that purpose, he shall be fined not exceeding $100.

[CHAP. 76, LAWS OF 1895.]

SEC. 1. *Purity of waters used for domestic purposes protected; penalty for defilement; exception.*—Whoever knowingly and willfully poisons, defiles, pollutes, or in any way corrupts the waters or ice of any well, spring, brook, lake, pond, river, or reservoir, used as the source of a public water or ice supply for domestic purposes, or knowingly corrupts the sources of the water of any water company or of any city or town supplying its inhabitants with water, or the tributaries of said sources of supply, in such a manner as to affect the purity of the water or ice so supplied at the point where the water or ice is taken for such domestic use, or puts the carcass of any dead animal or other offensive material into said waters or upon the ice thereof, shall be punished by a fine not exceeding $1,000 or by imprisonment not exceeding one year. The provisions of this section shall not apply to the deposit of any bark, sawdust, or any other waste of any kind arising from the business of cutting, hauling, driving, or storing logs, or the manufacture of lumber; and the use of any stream for the purposes of manufacturing and for the necessary drainage connected therewith, if more than 4 miles distant from the point where the water is taken for such domestic purposes, shall not be deemed a violation of this section.

SEC. 2. *The cutting of ice regulated; powers of supreme court.*—No person shall cut or take ice from any lake, pond, or reservoir used as the source of a public water or ice supply for domestic purposes for man, unless he first shall comply in all respects with such reasonable rules and regulations in regard to

the manner and place of cutting and taking such ice on said lake, pond, or reservoir as may be prescribed by the local board of control or officers of a water company who may have charge of the works of any city or town supplying its inhabitants with water from said lake, pond, or reservoir. The supreme court shall have power to issue injunctions restraining any person from cutting or taking ice from such lakes, ponds, or reservoirs until they have complied with the reasonable regulations made as aforesaid.

SEC. 3. *Regulations governing fishing, boating, and horse racing; penalty for violation.*—Said local boards and officers may also make all reasonable rules and regulations in regard to fishing and the use of boats in and upon any such lake, pond, or reservoir, and in regard to racing or speeding horses upon the ice thereof, which they may deem expedient. Any person who shall violate any of said rules and regulations after notice thereof shall be fined not exceeding $20 or imprisoned not exceeding six months.

SEC. 4. *Bathing in such waters prohibited; penalty.*—If any person shall bathe in such lake, pond, or reservoir within one-fourth of a mile of the point where said water is taken, he shall be fined not exceeding $20 or imprisoned not exceeding six months.

SEC. 5. *Willful injury to property punished.*—Whoever shall willfully injure any of the property of any water company or of any city or town used by it in supplying water to its inhabitants shall be punished by a fine not exceeding $1,000 or by imprisonment not exceeding one year; and such person shall also forfeit and pay to such water company, city, or town three times the amount of actual damages sustained, to be recovered in an action on the case.

[CHAP. 85, LAWS OF 1897.]

SEC. 1. *Boards of health to inspect sources of domestic ice supply.*—It shall be the duty of boards of health of the cities and towns of the State to examine and inspect the sources from which ice is cut, or is proposed to be cut, for domestic use in such cities and towns and to employ such means as may be necessary to determine whether the waters of such sources of ice supply have been polluted or whether ice taken therefrom will be deleterious to the public health.

SEC. 2. *If waters found polluted, board to give notice of danger, and that taking must cease.*—In each case where the waters of the sources of ice supplies shall be found so polluted that the ice taken therefrom will be unhealthy or unsafe for domestic use, the board of health of the city or town concerned in the same shall immediately notify such person or persons as may have taken, or who propose to take, ice from such polluted source for their own domestic use or for sale for domestic use, of the dangerous character of the waters inspected, and that the taking of such ice for domestic use must cease.

SEC. 3. *Punishment for cutting or taking from polluted waters or waters condemned by board.*—Whoever knowingly or willfully shall cut or take any ice for domestic purposes from any waters which are polluted with sewage or other substance deleterious or dangerous to life or health, or from waters which a board of health has condemned, shall be fined not exceeding $250 or imprisoned not exceeding six months.

[CHAP. 57, LAWS OF 1899.]

SEC. 1. *Protection of water or ice supply through State board of health.*—Whenever any board of water commissioners, local board of health, or 10 or more citizens of any town or city have reason to believe that a public water

or ice supply is being contaminated or is in danger of contamination and that the local regulations are not sufficient or effective to prevent such pollution, they may petition the State board of health to investigate the case and to establish such regulations as the said board may deem necessary for the protection of the said supply against any pollution that in its judgment would endanger the public health.

SEC. 2. *Regulations of State board of health.*—The State board of health shall, after due investigation, make such regulations as it may deem best to protect the said supply against any dangerous contamination, and the regulations so made shall be in force when a copy is filed with the town clerk and posted in two or more public places in said town or published in some newspaper in the county, and it shall be the duty of the local board of health to enforce said regulations.

SEC. 3. *Punishment for violation of such regulations.*—Any person violating any regulation established by the State board of health shall be punished by a fine of $20 for each offense, and a certified copy under oath of such regulation made by the secretary of the State board of health or by the town clerk, where the regulations are filed, shall be received as prima facie evidence of the existence of such regulations in any court of the State.

[CHAP. 72, ACTS OF 1901.]

SEC. 1. *Woodworking wastes not to befoul water supplies.*—All sawmills, planing mills, and other woodworking establishments hereafter constructed and put in operation in this State shall be so constructed and operated that no bark, sawdust, shavings, slabs, edgings, or other waste product therefrom shall escape into or be deposited, dumped, or placed in any lake, pond, or stream within the State, and no bark, sawdust, slabs, edgings, or other waste product from any sawmill, planing mill, or other woodworking establishment hereafter erected and put in operation shall be allowed to escape into or be deposited, dumped, or placed in any such lake, pond, or stream: *Provided, however*, That if the owner or operator of any such establishment has provided it with reasonably perfect modern machinery and appliances to prevent such product or waste from escaping into or being placed in any such lakes, ponds, or streams and keeps said machinery and appliances in reasonable repair he shall not be responsible for any product or waste that may escape from said establishment into said waters without negligence upon the part of himself or his employees: *And provided further*, That this act shall not apply to bark that gets into said waters from logs while being driven, rafted, or stored in said waters and before the process of manufacture begins.

SEC. 2. *Petition for relief from operation of this act.*—The supreme court, upon petition of any person hereafter desiring to erect a new mill or other establishment mentioned in this act alleging that it will be impracticable for him to profitably do so if obliged to comply with the provisions of this act, and that the public good will be promoted by granting him relief therefrom, upon hearing and satisfactory evidence to sustain the allegations contained in the petition, may grant the petitioner relief from the operation of this act, provided they are of the opinion that in view of all the circumstances justice requires that such relief should be granted and that the public good will be subserved by the granting of such relief.

SEC. 3. *Notice to be given interested persons.*—Reasonable notice of the petition shall be given to the fish and game commissioners, the selectmen of the town, or mayor of the city in which the establishment is to be erected and to such other persons as may be interested by a notice served on said parties and

a like notice published in a newspaper printed in the town or city or county, and said fish commissioners, selectmen, mayor, or other person interested therein may appear and object to the granting of such relief.

SEC. 4. *Penalty.*—Any person or officer of any corporation violating the provisions of this act shall be fined $50 for each offense, and every day that they violate the same shall be deemed a separate offense.

[CHAP. 38, LAWS OF 1903.]

SEC. 1. *Board may prohibit domestic use of polluted water; penalty.*—Whenever the State board of health, upon investigation, become satisfied that a well, spring, or other supply of water used for domestic purposes has become polluted so as to endanger the public health they are authorized to prohibit the person or corporation owning or controlling said supply from furnishing such water for domestic purposes until they become satisfied that said water supply has been purified and made fit for domestic use. Any person or corporation official or agent violating the order of the board shall be punished by a fine of not less than $100 and not exceeding $1,000 for each and every day they continue to furnish water for domestic purposes after the order of the board has been served upon them.

SEC. 2. *Superior court has jurisdiction to enforce orders.*—The superior court shall have jurisdiction in equity, upon application of the State board of health, to enforce the orders of said board, issued in accordance with the provisions of section 1.

[CHAP. 205, LAWS OF 1913.]

SEC. 1. *Sewage discharge restricted.*—In order to maintain the purity of streams, lakes, and rivers and to prevent further contamination no person, association, or corporation shall hereafter cause or permit the discharge of sewage or other deleterious waste from any factory, hotel, boarding house, or other commercial establishment into any stream, lake, pond, or river not hitherto polluted without first submitting detailed plans of said proposed discharge to the State board of health and securing the approval of the said board.

SEC. 2. *Proposed water systems to be approved.*—No person, association, or corporation proposing to supply water for domestic uses shall construct any new system or enlarge any existing system for supplying water to the citizens of any town or city without first submitting detailed plans of the proposed construction to the State board of health and securing its approval thereof. And it shall be the duty of the said State board of health to examine the topography and the watershed of the proposed supply, and shall also make chemical and bacteriological analyses of the waters of the proposed supply before approval is granted.

SEC. 3 (as amended by chapter 92, laws of 1915).—*State board of health to have supervision over auxiliary or emergency supplies of water, etc.*—No person, corporation, or association supplying water to the public for domestic use shall have resort to, hold in reserve, or maintain a connection through which water may be received from any auxiliary or emergency source of supply the quality of which has not been approved by the State board of health and under regular inspection thereby unless such source shall have been duly declared to and registered by the said board. Every valve, gate, or other device for controlling or preventing the inflow of water of such unapproved character to the public supply-pipe system must be of such construction as to permit of effective sealing or inspection, and such valves, gates, or other devices

shall be kept under or subject to the seal and inspection of the State board of health. Whenever it shall become necessary to break such seal or to resort to an unapproved emergency source, notice thereof within 24 hours shall be conveyed to the said board by telephone or telegraph and also by mail. The State board of health shall have full control and oversight of emergency intakes. It may, when feasible and deemed necessary for the protection of public health, upon reasonable notice require the abandonment of any existent emergency source and the adoption of other means of supply; and if in its judgment the circumstances warrant, it may order the permanent installation and continuous maintenance in connection therewith of some approved form of disinfecting apparatus or equipment. In case said board shall require the abandonment of any such emergency source, the person, corporation, or association aggrieved thereby shall have an appeal to the superior court in term time or vacation, said appeal to be taken within 30 days from the receipt of the order from said board, and said court may make such orders thereon as justice may require.

SEC. 4. (as amended by chapter 92, laws of 1915).—*Penalty.*—Whoever violates any of the provisions of this act or fails to comply with the lawful orders and requirements of the State board of health duly made and provided herein, or whoever hinders or obstructs any inspector in the pursuit of his lawful duty, shall be punished by a fine of not less than $100 nor more than $1,000.

[CHAP. 133, LAWS OF 1915.]

SEC. 36. *Poisons for taking fish forbidden.*—No person shall take any fish by the use of any poisonous, stupefying * * * substance. Possession of any such substance by a person on the waters, shore, or islands of this State * * * shall be a violation of the provisions of this section.

SEC. 45. *Use of poisonous substance in private waters forbidden.*—No person shall take fish in any private or artificial ponds prepared or used for the purpose of breeding, growing, or preserving fish, or any stream connected therewith wholly within the control of the person who owns the land around the same, * * * nor place therein any * * * poisonous or stupefying substance * * * without the permission of the owner or lessee of the land upon or through which such waters stand or flow.

[PUBLIC ACTS, 1917, CHAP. 125.]

SECTION 1. *Areas from which ice is being harvested must be marked.*—Hereafter any person or corporation harvesting ice upon any of the public waters of this State shall mark with suitable markers the area from which ice is to be taken at beginning of harvest, and shall maintain such markers as long as any danger exists.

SEC. 2. *Exception.*—This act shall not apply to ponds closed or areas set off by order of the fish and game commission under authority of chapter 74, Laws of 1909, and amendments thereto.

SEC. 3. *Penalty.*—Any person or any agent of any firm, company, or corporation violating the provisions of this act shall be fined $100 for each offense, or be imprisoned not exceeding 90 days, or both.

[PUBLIC ACTS, 1917, CHAP. 126.]

SECTION 1. *Pollution of Ellis and Wildcat Rivers prohibited.*—It shall be the duty of the local boards of health to inspect the cesspools or other systems of sewage at least once a year, and if any such cesspools or other systems of

sewage be deemed by said boards of health to pollute or contaminate the waters of the Ellis or Wildcat Rivers, or their tributaries, in such manner as to affect their purity for domestic purposes, the said boards of health shall cause the owners of such cesspools or other systems of sewage so deemed to pollute or contaminate said waters to alter or construct the same under the supervision and in accordance with the regulations of the State board of health.

SEC. 2. *Penalty.*—Whoever violates any of the provisions of this act shall be deemed to be guilty of a misdemeanor, and shall be punished by a fine of not more than $100, or by imprisonment not exceeding one month.

[POLLUTION OF WALKER POND. REG. BD. OF H., JULY 9, 1914.]

1. No privy, pigpen, stable, or other building or structure in which horses, cattle, swine, or other animals or fowls are kept, shall be built, continued, or maintained within 75 feet of Walker Pond (meaning high-water mark), or within 75 feet of any bay, cove, or inlet thereto, or within 75 feet of any stream tributary to said pond, bays, coves, or inlets, except in such cases as the local board of health may permit, upon the approval of the State board of health, and under such regulations as they may require.

2. No sink water, urine, or water that has been used for washing or cleansing either materials, person, or food shall be allowed to run into said pond, or into any bay, cove, or inlet thereof, or into any stream tributary thereto, or into any excavation or cesspool in the ground or on the surface of any ground within 75 feet of said pond (meaning high-water mark), or of any bay, cove, or inlet, or within 75 feet of any stream tributary thereto, except by consent and under such regulations and conditions as may be given by the local board of health, upon approval of the State board of health.

3. No dead animal, or fish, or parts thereof, or food, or any article perishable or decayable, and no dung, either human or animal, kitchen waste, swill, or garbage shall be thrown into or deposited in said pond, or left or permitted to remain within 75 feet thereof (meaning high-water mark), or into any bay, cove, or inlet of said pond, or into any stream tributary thereto, or within 75 feet of such bay, cove, or inlet, stream, or tributary.

4. No sawdust shall be thrown or be allowed to fall into said pond or into any stream tributary thereto.

5. No person shall bathe in said pond.

6. No matter, waste, or materials such as are described in sections 2, 3, and 4 shall be thrown, deposited, or allowed to remain upon the ice of the waters of said pond, or upon that of any bay, cove, or inlet thereof, or of any stream tributary thereto.

7. It is the duty of the local board of health to enforce the above regulations, and any person violating any regulation established by the State board of health shall be punished by a fine of $20 for each offense. Any deviations from the above rules must be by written consent of the State board of health.

[WATER SUPPLIES—REGULATIONS FOR THE PROTECTION OF BEAVER LAKE. REG. BD. OF H., JULY 9, 1914.]

1. No sewage of any kind, sink water, or water that has been used in washing or cleansing either materials, person, or food, shall be allowed to run into Beaver Lake, in the town of Derry, or into any stream tributary thereto. All excavations made for cesspools for sewage shall be so located or constructed that their contents will not in any manner pollute the said lake or its tributaries.

2. No privy, pigpen, cesspool, or place of deposit upon the surface of the ground for sewage, sink water, or water used for cleansing person or material shall be allowed to exist where it may be reached by high water in the event that the said lake or its tributaries overflow their usual channels, or where rain or melting snow would be likely to wash said material into said lake or its tributaries.

3. No dead animal, or parts thereof, or any article perishable or decayable, and no sewage, waste, or garbage shall be deposited so near said lake or its tributaries as to endanger the purity of the water.

4. None of these things, materials, or conditions mentioned in the foregoing regulations, or anything else that might endanger the purity of the said water or ice supply, shall be permitted to exist in such locality or manner as, in the opinion of the board of health, would be liable to contaminate the water or ice of the said lake or its tributaries.

5. It shall be the duty of the board of health to enforce these regulations, which shall take effect and be in force on and after August 1, 1914.

NEW JERSEY.

[COMPILED STATUTES, 1910,[1] CITIES.]

702. *Sewers not to be discharged into streams used for water supply.*—It shall be lawful for any city to expend not more than $50.000 in one year, $40.000 in the next succeeding year, and $30,000 in the third year, for the purpose of constructing sewers in such city: *Provided, however*, That any such sewer shall not be so constructed as to at any time empty or discharge any of its contents into any river, creek, stream, lake, pond, or watercourse, the waters of which are used for or connect with the waters of any river, creek, stream, lake, pond, or watercourse used for the supply of water to any aqueduct, water main, pipe, or reservoir of any city, town, township, or municipality of this State. (Public Laws, 1886, p. 239.)

733. *Construction of sewers or sewer system.*—It shall be lawful for any city in this State to provide for and cause to be constructed sewers and drains, or a system of sewerage and drainage, or either or any of them in the manner herein provided * * *. (Public Laws, 1890, p. 192, as amended by Public Laws, 1894, p. 177.)

785. *Pollution of streams not authorized by act relating to construction of sewers.*—No provision of any act which prohibits the pollution of any of the waters of this State used to supply any aqueduct or reservoir, or which are distributed for public use, is intended to be hereby[2] repealed, and this act shall not be construed to authorize the discharge of sewage into fresh water in such a manner as to defile a source of public water supply; nor is this act intended, nor shall it be held or construed, to deprive any person of any right of action for injury to person or to property, but any municipality exercising the powers conferred by this act shall, except where herein otherwise expressly provided be and remain liable for injuries resulting to person and to property in the same manner and to the same extent as if such municipality were a private corporation. (Public Laws, 1890, p. 209, as amended by Public Laws, 1899, p. 71.)

---

[1] In view of the fact that a large number of the laws quoted repeal by implication parts of other laws also quoted, it has seemed advisable to give the date of the law or amendment at the end of each section.

[2] Sec. 785 is sec. 47 of an act to provide for drainage and sewerage in cities of this State (Public Laws, 1890, p. 192). Sec. 733 is the first section of the same act. Intermediate sections omitted for the purpose of brevity.

799. *Unnavigable watercourse may be used for inclosed sewer if sewage does not flow into tidewater basin.*—In any city of this State, wherein any unnavigable creek or watercourse now exists, into which sewers of said city now empty, it shall be lawful for the official board of such city having the charge and control of sewers in such city * * * to cause to be constructed through such ancient unnavigable creek or watercourse an inclosed sewer * * *: *Provided, however*, That such sewer shall be constructed so as not to empty into any tidewater basin established by or under the authority of this State. into or permit, directly or indirectly, passage thereby of sewage into any tidewater basin established by or under the authority of this State. (Public Laws, 1894, p. 492.)

Preamble (to section 826–829[1]).—Whereas many of the cities of this State are so situated that they are traversed by rivers, streams, or creeks into which such cities drain all or part of their sewage thereby rendering such rivers, streams, or creeks foul, noxious, and detrimental to health: Therefore,

826. *Intercepting sewers; disposal of sewage.*—It shall be lawful for the city council, board of aldermen, or board of body having control of the finances of any city through which any river, stream, or creek runs and into which the sewage or part of the sewage of such city is emptied by such number of votes as may be required by the charter of such city or the rules of the governing body thereof for the expenditure of money for other purposes, to order and cause an intercepting sewer or sewers or a system of sewerage to be built and constructed in such city or any part thereof, and to alter a general system of sewage for such city or any part thereof so that all sewers within the district intended to be drained by such intercepting sewer and now emptying into such river, stream, or creek shall thereafter be connected with such intercepting sewer or sewers into which all sewage matter from such connecting sewers shall thereafter be discharged, and to establish one or more outlets or places of deposit within or without such city for sewerage [sic] and drainage, and to provide for the disposal of such sewage and drainage in such manner as said city council, board of aldermen, or board or body having control of the finances of such city may deem proper. (Public Laws, 1907, p. 267.)

827. *Cleansing watercourse used for receiving sewage.*—It shall be lawful for the city council, board of aldermen, or board or body having the control of the finances of any city aforesaid upon adopting and carrying into effect a plan for an intercepting sewer or general system of sewerage and drainage in accordance with the first section of this act [sec. 826] to cause any river, stream, or creek theretofore used for the purpose of receiving the sewage of such city, or any part thereof, to be cleansed and otherwise improved so as to render the same healthful and free from deleterious matter. (Public Laws, 1907, p. 268.)

833. *Throwing articles into stream which is the outlet of natural drainage of city.*—It shall be lawful for the city council, board of aldermen, or other governing body of any city aforesaid [any city in the State] to pass an ordinance or ordinances providing for penalties against persons convicted * * * of throwing or placing any article or thing in said river, stream, or creek [which is an outlet of the natural drainage or storm or surface flow of any city.] (Public Laws, 1907, p. 270.)

844. *Sewage-disposal plants.*—Cities of this State are hereby empowered to establish and maintain suitable plants, works, or stations for the treatment, disposal, or rendering of sewage. It shall be lawful for the municipal board, commission, or body of any city having charge of the sewers therein, to adopt

[1] Secs. 828 and 829 relate to assessments and bond issue and are therefore omitted.

an ordinance or ordinances providing for the construction and maintenance of a plant or works for the treatment, disposal, or rendering of the sewage of such city in accordance with a general plan in such ordinance or ordinances to be specified, which plan shall first be approved by the * * * [department] of health of the State of New Jersey as provided by chapter 72 of the session laws of 1900, and the acts amendatory thereof and supplementary thereto[1] * * *.

867. *City may pass ordinances to protect water.*—The said board of aldermen, council, or other legislative body of said city [any city in State] shall have the power, and they are hereby authorized, to make, ordain, and establish all such ordinances, resolutions, and regulations as said body may deem necessary and proper for the * * * protection of the said water [supplied to city] * * * (Revised acts, 1877, p. 723.)

873. *Polluting water in city reservoirs, etc.*—If any person or persons * * * shall pollute, corrupt, or render impure the water in any reservoir, aqueduct, conduit, or raceway erected, built, or laid down under the provisions of this act,[2] * * * such person or persons and their aiders and abettors shall forfeit to the said city, to be recovered in the name of the treasurer of said city in an action of trespass in any court of this State having cognizance of the same, triple the amount of damages which shall appear on trial to have been sustained, and all such acts are hereby declared to be misdemeanors, and the parties found guilty thereof may be further punished by fine not exceeding $500 or by imprisonment at hard labor not exceeding one year, or both, at the discretion of the court. (Revised acts, 1877, p. 725.)

969. *City may construct drains and sewers to protect water supply outside of city limits.*—In cities of this State having a public water supply derived from sources beyond the city limits it shall be lawful for the board or body having the control of such water supply to construct, maintain, and operate within the territory from which such water is derived or through which it flows, whenever it has become or may become necessary in order to protect such water from pollution, a system of drains and sewers for intercepting, taking off, and disposing of all sewage or other polluting matter. (Public Laws, 1907, p. 57.)

970 (as amended by Laws of 1913, p. 370). *Approval of State department of health required.*—In no case shall the construction of such system of drains or sewers be commenced or entered upon unless or until the State * * * [department] of health shall approve the construction of such system of drains or sewers as a sanitary measure and shall define in a general way the limits of the district or territory within which or for which such system of drains or sewers shall be constructed. (Public Laws, 1907, p. 57, as amended.)

971 (as amended by Laws of 1913, p. 370). *Sewage must be rendered harmless.*—Every system so constructed shall provide for the disposal of the sewage and other polluting matter taken up at a place and in a manner that shall render the same harmless, and before entering upon the construction of the same the plans prepared therefor shall have been presented to and approved by the State board of health. (Public Laws, 1907, p. 57, as amended.)

972 (as amended by Laws of 1913, p. 371). *Outhouses may be connected with sewer system by city.*—Whenever a sewer system shall be constructed as herein provided the board or body having charge of the water supply of such city shall have the power and authority at its own expense to connect such system with any outhouses or privy vaults along the line of the said sewer system or within the district indicated by the said State * * * [department] of health, and for this purpose may enter upon private or public lands and

[1] Sec. 82 et seq below under "Water supply."
[2] Public Laws, 1876, p. 366. Sec. 867 is a part of the act.

make the necessary excavations and connections and install proper appliances, at the expense of such city, for the flushing of outhouses and privy vaults. In all cases the surface of the ground wherein such excavations are made, shall be restored to its original condition as near as may be. (Public Laws, 1907, p. 58.)

973. *Private sewers to be connected with sewer system.*—Whenever any building or buildings along the line of the said sewer system or within the said district may at the time of the construction of the said system have been provided with a private drainage sewer, the board or body having charge of the water supply, under whose authority the sewer system hereby authorized is constructed, is hereby authorized, to connect such private sewer with the sewer system hereby authorized, and in the construction of the said connection shall have the right to enter upon all such lands and make the necessary excavations and constructions. (Public Laws 1907, p. 58.)

976. *Sanitary disposal of matter which can not be discharged into sewer.*—Whenever there shall be within the district designated and defined as aforesaid any outhouses, privy vaults, or private drainage sewers so located that they can not be connected with the sewer system hereby authorized and provided for, then it shall be lawful for the board or body having charge of the water supply of such city to enter upon such lands and at its own expense make some sanitary arrangements for the disposal of the sewage and polluting matter therefrom; and it shall have the right from time to time to inspect the operation of such constructions, and to maintain, regulate, and repair the same, and after such provision shall have been made, it shall be the duty of the owner of such lands to use the facilities thus provided for the disposal of sewage and house drainage. (Public Laws 1907, p. 59.)

977 (as amended by Laws of 1913, p. 372). *Use of system enforced.*—Whenever any system shall have been installed under the provisions of this act within the district defined, as herein provided, it shall be the duty of every person owning or occupying premises therein to use the facilities afforded for drainage and sewerage, and to cease using any other method for the disposal of house drainage, sewage, or other polluting matter, and the State * * * [department] of health is hereby authorized and directed to enforce the provisions of this act in this respect by appropriate proceedings at law or equity.

2166. *City council may prevent pollution of water.*—The city council of such city [any city which shall adopt the provisions of the act] shall have power to make, establish, publish, modify, amend, or repeal ordinances for the following:

XLI. To prevent the city water from being obstructed or contaminated, * * * and to provide for fines and penalties for the violation of all ordinances relating thereto. (Public Laws 1908, p. 312.)

2432. *Pollution of water supply in certain cities a misdemeanor.*—If any person shall willfully, unlawfully, and maliciously in any manner pollute, or render foul or impure any stream, lake, reservoir, or other source of supply of water for any such city [cities having less than 10,000 and more than 6,000 inhabitants] * * * shall be deemed guilty of a misdemeanor, and, on conviction, shall be punished by a fine not exceeding $100, or by imprisonment at hard labor not exceeding one year, or both. (Public Laws 1879, p. 163.)

2777. *Certain cities to protect water supply.*—The city council of such city [cities of the second class having less than 20,000 inhabitants] shall have power to make, establish, publish, modify, amend, or repeal ordinances for the following purposes:

XLII. To prevent the city water from being obstructed or contaminated, * * * and to provide for fines and penalties for the violation of all ordinances relating thereto. (Public Laws 1907, p. 196.)

[COMPILED STATUTES, 1910, CRIMES.]

84. *Pollution of waters distributed for public uses.*—Any person who shall throw, cause, or permit to be thrown into any reservoir, or into the waters of any pond or lake or brook, creek, or river of this State, which runs through or along the border of any city or other municipality, the waters of which are used to supply any aqueduct or reservoir for distribution for public use, any carcass of any dead animal or any offal or offensive matter whatsoever calculated to render said waters impure, or to create noxious or offensive smells, or shall connect any water-closet with any sewer or other means whereby the contents thereof may be conveyed to and into such pond or lake or brook or creek or river or reservoir, or shall so deposit, or cause or permit to be deposited, any such carcass, offal, or other offensive matter that the washing or waste therefrom shall or may be conveyed to and into any such pond or lake or brook or creek or river or reservoir, shall be guilty of a misdemeanor. (Public Laws, 1898, p. 818.)

86. *Pollution of waters used for ice supply.*—Any person who shall throw, cause, or permit to be thrown into the waters of any pond or lake or brook, creek, or river of this State, the waters of which may be used for the cutting and harvesting of ice, any carcasses of any dead animal or any offal or offensive matter whatsoever calculated to render said waters impure or create noxious or offensive smells, or shall connect any water-closet with any sewer or other means whereby the contents thereof may be conveyed to and into such pond or lake or brook, creek, or river, shall be guilty of a misdemeanor. (Public Laws, 1898, p. 819.)

141. *Poisoning fish.*—And person who * * * shall willfully or maliciously put any lime or other noxious material in any such pond or water [fishpond, private water, or water in which there is any private right of fishery] with intent thereby to destroy any of the fish that may then be or that may thereafter be put therein * * * shall be guilty of a misdemeanor. (Public Laws, 1898, p. 832.)

218. *Punishment for misdemeanor.*—Any person found guilty of any crime which by this[1] or any other statute is declared to be a misdemeanor shall be punished by a fine of not exceeding $1,000 or by imprisonment with or without hard labor, as the court may direct, for any term not exceeding three years, or both. (Public Laws, 1898, p. 854.)

[COMPILED STATUTES, 1910, FISH AND GAME.]

43. *Use of drugs for taking fish.*—It shall be unlawful to place in any of the waters of this State * * * any drug or poisoned bait for the purpose of taking, killing, or injuring fish under a penalty of $100 for each offense. (Public Laws, 1903, p. 534.)

44. *Deleterious substances in water.*—It shall be unlawful to allow any dyestuff, coal tar, sawdust, tank bark [sic], lime, refuse from gas houses, or other deleterious or poisonous substance or subtances to be turned into or allowed to run into any of the waters of this State in quantities destructive of life or disturbing the habits of the fish inhabiting the same under penalty of $200 for each offense. (Public Laws, 1903, p. 534.)

202. *Placing poisonous substances in Delaware River above Trenton Falls.*—It shall be unlawful for any person to put or place in the Delaware River above Trenton Falls any * * * poisonous substances whatsoever, any drug or any poison bait for the purpose of catching, taking, killing, or injuring the fish, or to

[1] Public Laws, 1898, p. 854.

allow any dyestuff, coal or gas tar, coal oil, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime, vitriol, or any of the compounds thereof, refuse from gas houses, oil tanks, or vessels, or any deleterious, destructive, or poisonous substances of any kind or character to be turned into or allowed to run, flow, wash, or be emptied into any of the waters aforesaid, unless it is shown that every practicable means has been used to prevent the pollution of waters in question by the escape of deleterious substances. In the case of the pollution of waters by substances known to be injurious to fishes or to fish food it shall not be necessary to prove that such substances have actually caused the death of any particular fish. Any person violating any of the provisions of this section shall, on conviction thereof, be subject to a fine of $200. (Public Laws, 1909, p. 408.)

222. *Placing poisonous substances in Delaware River below Trenton Falls.*—(Section is identical with section 202, except that it refers to the Delaware River below Trenton Falls.)

[COMPILED STATUTES, 1910, HEALTH.]

66. *No ice to be cut or sold within limits of city without permit from board of health.*—No ice shall be cut for the purpose of being sold or used in any city of this State from any pond, creek, or river within the limits of any such city unless a permit therefor shall be first obtained from the board of health of such city, and no person or persons shall sell or deliver any ice in any city in this State without first obtaining a permit therefor from the board of health of such city; and it shall be lawful for any such board of health to refuse a permit and to revoke any granted by them as aforesaid when in their judgment the use of any ice cut or sold, or to be cut or sold, under the same is or would be detrimental to the public health. (Public Laws, 1885, p. 104.)

67. *Board may prohibit sale and use of ice in certain cases.*—The board of health of any city may prohibit the sale and use of any ice within the limits of such city when in their judgment the same is unfit for use, and the use of the same would be detrimental to the public health, and the said board may prohibit and through its officers stop, detain, and prevent the bringing of any such ice for the purpose of sale or use into the limits of any such city, and also in the same manner stop, detain, and prevent the sale or use of any such ice found within the limits of such city. (Public Laws, 1885, p. 104.)

68. *Penalty for violating provisions of act.*—Any person or persons who shall violate any of the provisions of this act, or who shall attempt to cut, sell, or bring into any city any such ice after being notified by said board of health or its officers not to do so, shall be guilty of a misdemeanor, and on conviction shall be sentenced to imprisonment in the county penitentiary for a term not to exceed six months, or to pay a fine of $500, or both, in the discretion of the court; and it shall be lawful for the officers of said board of health or the police officers of any such city to arrest on sight any person or persons who shall be found violating any of the provisions of this act. (Public Laws, 1885, p. 104.)

69. *Provisions of sections 66–68 extended.*—The provisions of * * * [secs. 66–68] hereby are extended to all boroughs, townships, towns, and other local municipal governments in the State. (Public Laws, 1888, p. 160.)

84. *Permits to sell and deliver ice in cities.*—No person, firm, or corporation shall sell or deliver ice in any city of this State unless a permit therefor shall be first obtained by such person, firm, or corporation from the board of health of such city, and it shall be lawful for any such board of health to revoke any permit granted by it as aforesaid, when in its judgment the use of any ice that is to be sold or delivered under such permit is or would be detrimental to the public health; which revocation or any declination of the local board to

grant a permit shall be subject to appeal to the * * * [department] of health of the State of New Jersey, which last-named * * * [department] may order a permit to be granted or a revocation of a permit to be set aside and a new permit to be granted, which order shall be binding and effective on such local board. (Public Laws, 1909, p. 298.)

85. *Ordinances relative to sale and delivery of ice.*—Any board of health in any city in this State may adopt an ordinance prohibiting the sale or delivery of ice in said city without a permit therefor[1] from said board, and empowering said board to revoke any permit issued by it when in its judgment the use of any ice which is sold or delivered under said permit is or would be detrimental to the public health, and to prohibit the use in said city of any ice which is impure or taken from any polluted source, and to prescribe in such ordinance a penalty not exceeding $200 for a violation thereof, * * *. (Public Laws, 1909, p. 298.)

88. *Sale of impure ice in cities of first class may be forbidden.*—The board of health of each of the cities of the first class in this State shall have authority to provide by ordinance for the prohibition of the use or sale of impure ice or ice cut from polluted ponds or streams, and in order to properly carry out and enforce the provisions of such ordinance to provide that all dealers in ice for domestic or public use shall obtain from the health authorities of such cities a permit, and to fix in such ordinance a penalty for the violation of the same, which shall not exceed a fine of $50 for each offense. (Public Laws, 1895, p. 710.)

152. *When common council, etc., may exceed limit of authorized expenditure to construct sewers, etc.*—Whenever the board of health in any city of this State shall, after due examination and consideration, determine, by resolution in writing, adopted or concurred in by two-thirds of the members of said board, that it is necessary for the preservation of the public health, or the prevention of the cause or spread of disease, that a sewer or drain, or sewers or drains, should be constructed in any locality in said city, and shall certify to the common council or other legislative or governing body of such city such resolution and the reasons for which it was adopted, then said common council or other legislative or governing body, if in their judgment such sewer or drain, or such sewers or drains seem to be necessary as a sanitary measure, may construct or order, direct and cause such sewer or drain, or sewers or drains, to be constructed, although the limit of authorized expenditures for public improvements in such city would thereby be exceeded: *Provided*, That such excess of expenditure shall not in any case exceed the sum of $50,000 in any one year. (Public Laws, 1881, p. 288.)

239. *Unlawful to permit or discharge "sludge acid" into streams.*—From and after the passage of this act it shall be unlawful for any person, persons, corporation or corporations, to permit the discharge or escape, directly or indirectly, of such refuse or residuum, resulting from the refining of petroleum, as is commonly called "sludge acid," into or upon any river, stream, watercourse, lake, pond, or other body of water, or any tidal waters within or bordering upon this State; and every violation of this act shall constitute a public nuisance and shall be punishable as such. (Public Laws 1884, p. 221.)

240. *Penalty.*—Every person, persons, corporation, or corporations violating, or whose servants or agents shall violate this act, in addition to the penalty indicated in section 1 of this act, shall forfeit and pay the sum of $1,000 for each violation of this act which shall be proved, to be recovered in any court of competent jurisdiction by any person who shall sue for the same, one-half of said penalty to go to such person so suing therefor and the other half to go to the State. (Public Laws 1884, p. 221.)

[1] Text reads "therefore."

[COMPILED STATUTES, 1910, ICE DEALERS.]

1. *From what waters persons having ice-houses may gather ice.*—It shall be lawful for all persons having ice-houses upon the waters of this State to gather the ice in front of their lands to the middle of the several streams, ponds, and lakes upon which they are located. (Public Laws 1871, p. 21.)

2. *Ice dealers not to be interfered with.*—During the time the several ice dealers are gathering their ice crops, it shall not be lawful for any person to interfere with the same except for the purposes of navigation. (Public Laws 1871, p. 21.)

3. *To whom this act shall not extend.*—The provisions of this act shall not extend to the owners of mill ponds, nor shall it extend to parties having the mere right of way upon the shores of the several watercourses of this State. (Public Laws 1871, p. 21.)

4. *Penalty for polluting ice or destroying machines for the gathering the same.*—If any person or persons shall maliciously or willfully pollute, corrupt, or render impure the ice in front of the lands of persons having ice-houses, as described in the first section of the act to which this is a supplement, or shall willfully or maliciously destroy any engine, machine, tools, or other property used for the gathering and storing such ice, the person or persons so offending shall be deemed guilty of a misdemeanor, and being thereof convicted, shall be punished by a fine not exceeding $100 or imprisonment at hard labor not exceeding one year, or both. (Public Laws 1882, p. 92.)

[COMPILED STATUTES, 1910. PETROLEUM.]

5. *Definition of term "pipe line."*—The term "pipe line" wherever used in this act [secs. 5–15] shall mean any conduit through which petroleum or any of its products is conveyed or intended so to be. (Public Laws, 1884, p. 293.)

6. *Construction across fresh-water streams.*—Hereafter it shall not be lawful to construct any pipe line across any fresh-water streams in this State except in the manner to be approved by the State commissioners of water supply. (Public Laws, 1884, p. 294.)

7. *Reconstruction.*—If any pipe line now existing or hereafter constructed is or shall be so constructed that there is danger of the escape of its contents into any of the fresh-water streams of this State, it shall be reconstructed or removed in accordance with the provisions of this act. (Public Laws, 1884, p. 294.)

14. *Penalty for failure to reconstruct.*—If any pipe line shall hereafter be constructed or maintained across any fresh-water stream in this State, except in the manner approved by the State commissioners of water supply, the owners or users so constructing or maintaining the same shall be liable to a penalty of $500 for each day they shall delay reconstructing the same, as shall be or shall have been approved by the said commissioners, according to the provisions of this act, which shall be recoverable at law in any court of competent jurisdiction by the said commissioners in the name of the State of New Jersey from the owners or users of such pipe line: *Provided, however*, That the owners of pipe lines now constructed shall not be liable to this penalty until after due notice and hearing, as provided in this act: *And provided further*, That nothing shall be so construed in this act as to relieve the owners or users of pipe lines from liability for damages which may ensue by reason of breakage or leakage, notwithstanding said pipes were constructed according to the direction and with the approval of the State commissioners of water supply. (Public Laws, 1884, p. 296.)

15. *State commissioners of water supply defined.*—The State commissioners of water supply, referred to in the title and body of this act, are the commissioners appointed under chapter 189, Laws of 1882 [secs. 4 and 6 under "Water supplies"], and their successors however appointed or designated. (Public Laws, 1884, p. 296.)

[COMPILED STATUTES, 1910, TOWNS.]

114. *Discharge of sewers into certain watercourses forbidden.*—* * * *Provided*, That no such sewer or sewers [outlet sewer or sewers leading to tidewater across intervening territory of other municipalities] shall be so constructed as to empty or discharge any of its or their contents into any creek, stream, lake, pond, or watercourse, the waters of which are used for or connect with waters used for the supply of water to any aqueduct, water main, or reservoir of any city, township, or other municipality of this State. (Public Laws, 1895, p. 186.)

203. *Penalty for polluting water in reservoir.*—If any person or persons shall willfully pollute or adulterate the waters in any reservoir erected under the provisions of this act [act enabling incorporated towns to construct water works], any person so offending shall be deemed guilty of a misdemeanor and on conviction thereof shall be punished by fine not exceeding $500 or by imprisonment at hard labor not exceeding three years, or both, at the discretion of the court before whom such conviction shall be had. (Public Laws, 1884, p. 50.)

240. *Penalty for polluting water in any reservoir.*—If any person or persons shall willfully pollute or adulterate the waters in any reservoir erected under the provisions of this act [act enabling towns and townships[1] to construct waterworks], any person so offending shall be deemed guilty of a misdemeanor and on conviction thereof shall be punished by fine not exceeding $500 or by imprisonment at hard labor not exceeding three years, or both, at the discretion of the court before whom such conviction shall be had. (Public Laws, 1893, p. 153.)

[COMPILED STATUTES, 1910, WATER SUPPLY.]

4. *Commissioners appointed.*—There shall be appointed by the governor four commissioners for the purposes hereinafter named, who shall serve without pay,[2] and whose expenses shall be paid * * *. (Public Laws, 1882, p. 264.)

6. *Duties of these commissioners.*—Said commissioners, when applied to, * * * shall consider and determine upon such plans as they may deem most practicable for the storage of any of the waters of this State for the purpose of furnishing any of the cities and towns of this State with a good and sufficient water supply.[3] (Public Laws, 1882, p. 264.)

12. *State water supply commission (now department of conservation and development) established.*—The governor, by and with the advice and consent of the senate, shall appoint five citizens of this State to constitute a commission, to be known as the State water-supply commission [department of conservation and development]. * * * It shall be charged with a general supervision over all the sources of potable and public water supply, to the end that the

[1] Public Laws, 1899, p. 424, repeals this law in so far as it relates to townships.

[2] An amendment to sec. 10 made the following year (Public Laws, 1883, p. 233) gave to each commissioner $5 for every day actually employed in the duties of his office.

[3] This law was given in the Compiled Statutes of 1910 in its entirety (as amended); but it seems unnecessary to give it here, as the duties of the commission appear to have been entirely taken over by the State water supply commission (later the department of conservation and development). However, the commission was not abolished by law. See also under "Petroleum."

same may be economically and prudently developed for the use of the people of this State. (Public Laws, 1907,, p. 633.)

13. *Plans for municipal water supply must be submitted to department of conservation and development.*—No municipal corporation, corporation, or person engaged in supplying or proposing to supply the inhabitants of any municipal corporation with water shall have power to condemn lands or water for any new or additional source of water supply or to divert water from such new or additional source until such municipal corporation, corporation, or person has first submitted descriptions thereof * * * to said * * * [department], and until said * * * [department] shall have approved the same: *Provided*, That nothing in this section shall be interpreted to restrict any municipality in acquiring, by purchase or condemnation, any existing or operating waterworks supplying said municipality with water * * *. (Public Laws, 1907, p. 634.)

21. *Supervision extends to well, subsurface, and percolating water supplies.*—The * * * [department of conservation and development] shall have the same jurisdiction and supervision over well, subsurface, or percolating water supplies now or hereafter furnished to the inhabitants of any municipal corporation as it now has over surface water supplies so furnished, except as such jurisdiction and supervision may be herein modified. (Public Laws, 1910, p. 551.)

22. *Approval of department necessary for use of subsurface, well, or percolating water supplies.*—(Section practically identical with 13 above, except that it refers to well, subsurface, and percolating water supplies.) (Public Laws, 1910, p. 551.)

28. *Department of conservation and development may contract with municipality to supply water.*—The * * * [department of conservation and development] may contract with any municipality or municipalities to provide the inhabitants thereof with water for public or private use, and the municipality or municipalities may enter into such contract in the manner and upon the terms hereinafter mentioned.[1] (Public Laws, 1910, p. 546.)

38. *Supervision of water-supply districts by department of conservation and development.*—Whenever the legislature by special act shall create and establish a water-supply district within this State, defining the territory included therein, such territory and the development thereof so far as the purposes of this act [secs. 38–46, Compiled Laws of 1910, under "Water supply"] are concerned, shall be under the care and supervision of * * * [the department of conservation and development] which shall have, in addition to the powers already enjoyed by it, all other power and authority proper and necessary to carry out and effectuate the purposes and objects of this act. (Public Laws, 1907, p. 639.)

39. *Control and storage of water, etc., by department.*—Said * * * [department] is hereby given full power and authority to devise and adopt plans for suitable works for the storage and control of waters flowing through said district or any part thereof and to make, construct, and maintain such dams, reservoirs, sluices, canals, aqueducts, and other works as may be appropriate for preventing damage to property in said district from the overflow of any such river or rivers, and also for the preservation, storage, and retention of said waters which would otherwise be wasted * * *. (Public Laws, 1907, p. 640.)

[1] It appears unnecessary to quote the sections of this act (Public Laws, 1910, Compiled Laws, 1910, secs. 28–37, under "Water supply," p. 546) which give the terms of such contract. The act is supplemented by Public Laws, 1911, p. 526 and p. 533, neither of which need be given herein.

47. *Pollution of Passaic River and tributaries prohibited.*—No person or persons, natural or artificial, shall throw, cause, or permit to be thrown into the waters of the Passaic River or of any of the tributaries thereof above the great falls of the Passaic River at Paterson any carcass of any dead animal or any offal or offensive matter or any matter or thing detrimental to health; no person or persons, natural or artificial, shall discharge or cause to be discharged into the waters aforesaid any sewage from any privy, water-closet, house, shop, drain, or place whatsoever; no person or persons, natural or artificial, shall deposit or cause or permit to be deposited any carcass of any dead animal, offal, or offensive matter so that the washing or waste therefrom shall or may be conveyed to and into the waters aforesaid. (Public Laws, 1897, p. 99.)

48. *Maintenance of buildings whose drainage might pollute said river.*—No person or persons, natural or artificial, shall maintain or erect or cause or permit to be maintained or erected any privy, water-closet, slaughterhouse, or other structure the drainage from which might or would tend to pollute the waters or any part of the waters aforesaid within such a distance from the banks of the said Passaic River or of any of the tributaries thereof above the great falls of the Passaic River at Paterson as would make the drainage from any such privy, water-closet, slaughterhouse, or other structure be liable to drain into the waters aforesaid or any part thereof by such drainage, percolation, or otherwise. (Public Laws, 1897, p. 99.)

49. *Penalty.*—Any person or persons, natural or artificial, violating any of the provisions of this act [secs. 47–54] shall forfeit and pay a penalty of $20 for each violation; * * * the maintenance of anything hereinbefore prohibited to be maintained shall be and is hereby constituted a separate violation for each day of maintenance. (Public Laws, 1897, p. 100.)

53. *Restraining violations.*—Any of the local boards of health hereinbefore referred to [any board of health having jurisdiction over territory bordering on Passaic River or its tributaries] may file a bill in the court of chancery, in the name of the State, on the relation of such local board of health, for an injunction to prohibit the maintenance of anything, the maintenance of which is hereinbefore prohibited, and such action shall proceed in the court of chancery according to the rules and practice of the court. (Public Laws, 1897, p. 101.)

54. *Abatement of pollutions by chancery court.*—In all cases in which it shall be ascertained by the court of chancery in such suit that anything is maintained contrary to the provisions of this act, that court shall have power to abate the same and prevent its further maintenance by injunction or otherwise, according to the practice of the court, and may charge the costs of such suit upon the defendant or defendants and enforce the collection thereof according to its rules and practice. (Public Laws, 1897, p. 101.)

(55–60. Public Laws, 1898, p. 283. This act establishes a commission to consider the subject of the pollution of the rivers and streams of New Jersey, to provide a plan for the prevention thereof, and for the relief of the persons and property affected thereby, and to provide for the expenses necessary for that purpose. As there is nothing in the act to indicate that the commission was to be permanent, the text is omitted from this appendix, although the law is given in the Compiled Statutes.)

61. *Prohibiting pollution of potable water.*—No excremental matter, domestic, factory, workshop, mill or slaughterhouse refuse, creamery or cheese factory waste, garbage, dyestuff, coal tar, sawdust, tan bark, or refuse from gas houses, other polluting mater shall be placed in, or discharged into, the waters, or placed or deposited upon the ice of any river, brook, stream, or any tributary

or branch thereof, or of any lake, pond, well, spring, or other reservoir above the point from which any city, town, borough, township, or other municipality, shall or may obtain its supply of water for domestic use; nor shall any such excremental matter, domestic, factory, workshop, mill, or slaughterhouse refuse, creamery or cheese factory waste, garbage, dyestuff, coal tar, sawdust, tan bark, or refuse from gas houses, or other polluting matter, be placed or suffered to remain upon the banks of any such river, brook, stream, or of any tributary or branch thereof, or of any lake, pond, well, spring, or other reservoir, above the point from which any city, town, borough, township, or other municipality shall or may obtain its supply of water for domestic use as aforesaid; and any person or persons, or private or public corporation, which shall offend against any of the provisions of this section, shall be liable to a penalty of $100 for each offense; and each week's continuance, after notice by the State or local board of health to abate or remove the same, shall constitute a separate offense: *Provided, however*, That nothing in this section contained shall be construed to repeal, modify, or otherwise affect any law or statute now conferring upon any local board of health the power or authority to institute any proceedings in any court of this State for the recovery of any penalty for, or obtaining any injunction against, the pollution of any of the waters of this State. (Public Laws, 1899, p. 73, as amended by Public Laws, 1909, p. 226.)

63. *Supervision of purity of water supply by State department of health.*—The State * * * [department] of health shall have the general supervision, with reference to their purity, of all rivers, brooks, streams, lakes, ponds, wells, springs, or other reservoirs in the State, the waters of which are or may be used as the source or sources of public water supplies for domestic use, together with the waters feeding the same, and shall have the authority, from time to time, as they deem necessary or proper to examine the same and to inquire what, if any, pollutions exist and their causes; and the said State * * * [department] of health in carrying out the provisions of this section may from time to time as they deem it necessary or proper address inquiries in printed or written form to any local board of health, municipal or township authority, corporation, or person or persons, which inquiries it shall be the duty of the persons or parties addressed to answer within such time as the said State * * * [department] of health may in such inquiries prescribe. (Public Laws, 1899, p. 75.)

64. *Injunction to prohibit further violations.*—If any person or persons, corporation or corporations, city, town, borough, township, or other municipality of this State, or any municipal or township authority, shall violate any of the provisions of the first section of this act [sec. 61], it shall be lawful for the said State * * * [department] of health, instead of proceeding in a summary way to recover the penalty prescribed in said section, to file a bill in the court of chancery in the name of the State on the relation of such * * * [department] for an injunction to prohibit the further violation of the said section * * *. (Public Laws, 1899, p. 76.)

61–64 supplemented by the following act (Laws of 1912, p. 556):

1. *Notification required where alterations to water plant will affect purity of supply.*—Whenever any person or corporation furnishing water for potable purposes finds it necessary for any reason whatever to make any change, temporary or permanent, in the operation of their plant or in the manner of furnishing such water which may in any way, either temporarily or permanently, tend to deteriorate the potable quality of the water so furnished by pumping directly into reservoirs or supply mains untreated water when the ordinary supply is subjected usually to some form of purification treatment or by any other similar

or dissimilar change in said supply, the tendency of which is to cause polluted waters to be forced into distributing pipes, the said person or corporation, before making such change or, in case of emergency, requiring the immediate making of changes in the operation of the plant or in the manner of furnishing such water, within six hours after making such change shall notify the local board of health and shall also notify, by telegraph or telephone, the State board of health as to the character and estimated duration of such change.

2. *Penalty.*—Every person or corporation violating any of the provisions of this act, either by corporate action or the unauthorized act of an employee, shall be subject to a penalty of $100, to be recovered in an action of debt by the local board of health, or, if there is no local board of health, then at the suit of the State * * * [department] of health.

3. *Notification will not prevent suit by aggrieved person.*—Nothing herein contained shall operate to relieve such person or corporation from any suit or action on behalf of any person aggrieved by the action of such person or corporation in making any such change as is referred to in paragraph 1 of this act.

65. *Sale of potable water.*—No person or corporation now or hereafter engaged in the distribution or sale of water for potable purposes shall deliver to any consumer any water which, in the opinion of the * * * [Department] of Health of the State of New Jersey, is polluted, contaminated, or impure, or which is obtained from any source which, in the opinion of the * * * [Department] of Health of the State of New Jersey, is or may become polluted, contaminated, or impure, unless purification by filtration or other means acceptable to the * * * [Department] of health of the State of New Jersey shall be accomplished before such water is distributed. (Public Laws, 1909, p. 457.)

66. *Dealers to show source.*—Every person or corporation intending to furnish water for potable purposes shall submit to the * * * [Department] of Health of the State of New Jersey a detailed report containing all information regarding the source from which supply is to be derived, and until such source has been approved by the * * * [Department] of Health of the State of New Jersey it shall be unlawful for said person or corporation to distribute such water to any consumer or consumers for potable purposes. (Public Laws, 1909, p. 457.)

67. *Plans for purification plant approved by State board of health.*—Every person or corporation desiring to install a purification plant for the purification of water intended for potable use shall submit detailed plans and specifications for such purification plant to the * * * [Department] of Health of the State of New Jersey, and such plant shall not be constructed or operated until the aforesaid plans and specifications shall have been approved by the * * * [Department] of Health of the State of New Jersey. (Public Laws, 1909, p. 457.)

68 (as amended by Laws 1915, p. 710). *Supervision of water plants.*—The * * * [Department] of Health of the State of New Jersey shall have the supervision of the operation of all water plants throughout the State with respect to the purity of the supply of potable water furnished by any such water plant, and every person or corporation furnishing water for potable use shall comply with any and all orders of the * * * [Department] of Health of the State of New Jersey relating to the purity of such waters. The * * * [Department] of Health of the State of New Jersey shall cause to be collected (by its inspectors or other authorized agents), as often as they shall deem necessary (but not less than four times each year), a sample or samples of the water supplied by each person or corporation furnishing water for potable use. Any person or corpo-

ration failing to allow the sample or samples for analysis to be collected as provided for in this section, or interfering with any member of the * * * [Department] of Health of the State of New Jersey, or duly authorized agent or employee of said * * * [department], in the supervision of any water plant, shall be liable to a penalty of $100, to be recovered in an action of debt by the * * * [Department] of Health of the State of New Jersey.

69. *Investigations of violations.*—The * * * [Department] of Health of the State of New Jersey shall have the power, and it shall be the duty of said board to investigate any and all violations of any of the provisions of this act. (Public Laws 1909, p. 458.)

70. *Injunction to prohibit violations.*—It shall be lawful for the * * * [Department] of Health of the State of New Jersey to file a bill in the court of chancery, in the name of the State on the relation of said board, for an injunction to prohibit any violation of any of the provisions of this act other than the violations enumerated in * * * [sec. 68], for which a penalty is provided, and every such action shall proceed in the court of chancery according to the rules and practices of bills filed in the name of the attorney general on the relation of individuals, and cases of emergency shall have precedence over other litigation pending at the time in the court of chancery, and may be heard on final hearing within such time and on such notice as the chancellor shall direct. (Public Laws 1909, p. 458.)

71. *Definitions.*—The word "person," as used in this act, shall be construed so as to mean any firm or copartnership, and the word "corporation" to include any municipal corporation. (Public Laws 1909, p. 459.)

72. *Boundaries of watershed wholly in State set out.*—Upon the formal request of the board of water commissioners, or other board or official having charge of the public water supply of any city of this State, which said water supply is derived from surface drainage in any watershed wholly within this State, it shall be the duty of the * * * [Department] of Health of the State of New Jersey to prescribe and fix territorial limitations bounding such watershed, which shall thereafter be known as _____ watershed. The name of such watershed to be inserted in the certificate hereinafter provided. (Public Laws 1909, p. 213.)

73. *Notice to public and railroad affected.*—The board of water commissioners, or other board or official making such application to the * * * [Department] of Health of the State of New Jersey, shall, upon the certificate of the said board setting out the boundaries of the said watershed, give public notice of such establishment, by advertisement in two newspapers of general circulation in the vicinity of the said watershed, at least once a week for four weeks, which advertisement shall run in the name of the * * * [Department] of Health of the State of New Jersey, and shall contain such sufficient description of the boundaries adopted as will identify the said watershed and the boundaries thereof, and a copy thereof be served upon any agent in charge of any ticket office of any railroad affected by the provisions of this act. (Public Laws 1909, p. 214.)

74. *No discharge into such watershed.*—When such territorial limitations for any such watershed shall have been established by the * * * [Department] of Health of the State of New Jersey, and notice thereof shall have been given in the manner herein prescribed, it shall thereafter be unlawful for any railroad company operating trains, or steamboat or power-boat company operating boats within the territorial limitations of such watershed, to discharge or allow any discharge from water-closets and urinals upon railroad trains or any such steam or other power boats as may be operated therein within the territorial limitations prescribed for such watershed. (Public Laws 1909, p. 214.)

75. *Penalty; how recoverable.*—Every corporation violating the provisions of this act shall incur a penalty of not exceeding $100, to be recovered in an action of debt at the suit of the board of water commissioners or other board or official having charge of the water supply of such city as shall derive its supply from said watershed; and all moneys which shall be recovered in such manner shall be paid into the treasury of the State; and every person violating any provision of this act shall be guilty of a misdemeanor. (Public Laws 1909, p. 214.)

76 (as amended by Public Laws, 1913, p. 329). *Discharging of sewage, etc., into fresh water.*—No person shall hereafter discharge or permit to be discharged into any fresh water any sewage, excremental matter, domestic refuse, or other polluting matter. The term "fresh water" as used in this act shall be taken to mean and include all water commonly known as fresh and which may be used for human consumption, irrespective of whether such water shall be found in a stream where the tide ebbs and flows or not: *Provided*, That nothing in this section shall prohibit the discharge of the effluent from any sewage-disposal plant or plant for the treatment of sewage heretofore approved by the State sewerage commission when said commission existed, or heretofore or hereafter approved by the * * * [Department] of Health of the State of New Jersey, so long as said sewage-disposal plant or plant for the treatment of sewage is operated in accordance with the requirements of law and the orders and regulations of the said * * * [Department] of Health of the State of New Jersey, but if said * * * [department] of health shall determine that such sewage-disposal plant or plant for the treatment of sewage is not operated in accordance with the requirements of law, or if the effluent from said plant is determined by said * * * [department] of health to be insufficiently purified, then the provisions of this section shall apply to such effluent.

77. *Penalty.*—Any person who shall violate any of the provisions of this act shall be liable to a penalty of $50 for each offense, to be recovered in an action of debt by the * * * [Department] of Health of the State of New Jersey, said penalty when recovered by said * * * [Department] of Health of the State of New Jersey to be paid into the treasury of this State. (Public Laws, 1910, p. 337.)

78. *Notice to discontinue violation.*—It shall be the duty of the * * * [Department] of Health of the State of New Jersey to give notice in writing to any person violating the provisions of this act, to discontinue such violation, and if said violation be not discontinued within 10 days from the date of service of said notice, then it shall be lawful for the said * * * [department] of health to institute a suit to recover the penalty provided for in the second section of this act. The said notice shall describe in general terms the location of the premises from which said violation occurs. (Public Laws, 1910, p. 337.)

79. *Injunction to restrain violation.*—Whenever any person shall violate any of the provisions of this act, it shall be lawful for the State * * * [department] of health, either before or after the institution of proceedings for the collection of the penalty imposed by this act for such violation, to file a bill in the court of chancery in the name of the State, at the relation of such board, for an injunction to restrain such violation and for such other or further relief in the premises as the court of chancery shall deem proper, but the filing of such bill, or any of the proceedings thereon, shall not relieve any party to such proceedings from the penalty or penalties prescribed by this act for such violation. (Public Laws, 1910, p. 338.)

80. *"Person" defined.*—The word "person" as used in this act shall be construed to imply both the plural and the singular, as the case may demand.

and shall include corporations, companies, associations, and societies, as well as individuals, and the word "corporations" shall include municipal corporations. (Public Laws, 1910, p. 838.)

81. *How act is to be construed.*—Nothing in this act contained shall be construed to operate as a repeal of any act of the legislature designed to secure the purity of the public supplies of potable water, or to prevent the pollution of streams, whether such streams be tidewater streams or not, but this act shall be deemed only to be additional legislation.

86. *Department of health to investigate methods of sewage disposal, etc.*—It shall be the duty of * * * [the State department of health] to investigate the various methods of sewage disposal, in order that it may be able to make proper recommendations in regard thereto; it shall investigate all complaints of pollution of the waters of this State which shall be brought to its notice, and if the said * * * [department] find that any of the waters of this State are being polluted, to the injury of any of the inhabitants of this State, either in their health, comfort, or property, it shall be the duty of said * * * [department] to notify in writing any person, corporation, or municipality found to be polluting said waters that prior to a time to be fixed by said * * * [department], which time shall not be more than five years from the date of said notice, said person, corporation, or municipality must cease to pollute said waters and make such disposition of their sewage or other polluting matter as shall be approved by the State * * * [department of health]: *Provided, however*, That any person, corporation, or municipality aggrieved by the said finding may appeal therefrom to the court of chancery at any time within six months after being notified thereof, and the said court is hereby authorized and empowered to hear and determine such appeal in a summary manner according to the course and practice of said court in other cases and thereupon to affirm the finding of said * * * [department] or to reverse or modify such finding in whole or in part, as to the said court shall seem just and reasonable. (Public Laws, 1900, p. 115.[1])

87. *Unlawful to build sewers so as to pollute streams.*—It shall be unlawful for any person, corporation, or municipality to build any sewer, drain, or sewerage system from which it is designed that any sewage or other harmful and deleterious matter, solid or liquid, shall flow into any of the waters of this State so as to pollute or render impure said waters, except under such conditions as shall be approved by the State * * * [department of health]: *Provided*, That the provisions of this section shall not be deemed to prohibit the use or extension of existing sewers, drains, or sewerage systems, unless the person, corporation or municipality controlling said sewer, drain, or sewerage system shall be served with a notice to cease pollution as provided by * * * [sec. 86]. (Public Laws, 1900, p. 115.)

88. *Discharge of sewage plant.*—It shall be unlawful for any person, corporation, or municipality to build or cause to be built, or operate, any plant for the treatment of sewage or other polluting substance, from which the effluent is to flow into any of the waters of this State, except under such conditions as shall be approved by the State * * * [department of health], to whom any new plans shall be submitted before building. (Public Laws, 1900, p. 116.)

89. *Where unlawful to allow discharge.*—It shall be unlawful for any person, corporation, or municipality, after the date specified in the notice provided for by * * * [sec. 85], to permit or allow any sewage, or other polluting mat-

[1] This law establishes a State sewerage commission, the duties of which were transferred to the department of health (then board of health) by Public Laws, 1908 (p. 605), as amended by Public laws, 1909 (p. 215). See section 127 below.

ter, to flow into said waters from any sewer, drain, or sewerage system, under the control of said person, corporation, or municipality, except under such conditions as shall be approved by the State * * * [department of health]. (Public Laws, 1900, p. 116.)

90. *When injunction may be invoked.*—It shall be lawful for the * * * [department] to apply to the court of chancery of this State for a writ or writs of injunction to prevent the violation of the provisions of this act, and it shall be the duty of the said court, in a summary way, to hear and determine the merits of said application, and to restrain, in all such cases, any person, corporation, or municipality from polluting any of the waters of this State, in violation of the provisions of this act. (Public Laws, 1900, p. 116.)

91. *Information regarding disposition of sewage.*—* * * whenever required by said * * * [department], the mayor of every municipality and the chairman of every township committee of every township now having, using, owning, leasing, or controlling a sewerage plant or system, shall furnish to said commission, on blanks to be provided by said * * * [department], a statement showing the disposition made of the sewage of their respective municipalities or townships, and as near as possible the amount discharged each 24 hours, and such other information and data as may be called for by said banks, to be provided as aforesaid by said * * * [department]. (Public Laws, 1900, p. 116.)

93. *Sewerage districts.*—And whereas, in order to prevent the pollution of the waters of this State, it is deemed necessary to establish a proper system or systems of sewerage and drainage wherein may or may not be included a system or systems of sewage-disposal works for the scientific treatment and proper disposal of sewage and sewage matter and the effluent thereof, and the establishment of any such system or systems may render proper or necessary the formation or creation of sewerage districts embracing portions or the whole of the territory of two or more of the municipalities of this State within which districts such system may be constructed, maintained, and operated, and such municipalities may be unable, through lack of power and authority, or otherwise, to agree upon the establishment of any such system or systems or upon the extent or limits of the territory of their respective municipalities to be included in any such district or districts and devoted to the uses and purposes of any such system or systems as aforesaid; therefore, upon presentation to said * * * [department of health] of a petition in writing, * * * requesting said * * * [department] to create and establish such district for either or both of the purposes aforesaid; * * * it shall be lawful for said * * * [department of health] to appoint a time and place when and where it will attend and give public hearing of the matters contained in said petition to all persons and parties interested therein; * * *. (Public Laws, 1900, p. 117.)

94. *Department of health may establish such district.*—If after such hearing, said * * * [department], or a majority thereof, shall deem it advisable to comply with the request of said petition, and that a district for the purpose or purposes, or either of them therein stated, should be created and established, said * * * [department] shall adopt a resolution to that effect * * * *. (Public Laws, 1900, p. 119.)

95. *Election of members to sewerage board.*—After the creation and establishment of any sewerage district as aforesaid, an election shall be held therein at the same time as the next annual election for members of assembly shall be held throughout this State; * * * at such first election the legal voters resident in said district shall elect five persons, resident in said district, to be

members of and compose the "sewerage board of district No. —," as the case may be; and annually thereafter * * * the legal voters resident in said district shall elect one person, resident in said district, to be a member of said sewerage board, to serve for the term of five years * * *. (Public Laws, 1900, p. 120.)

105. *Power of sewerage board.*—Any such board * * * shall have full power and authority within its respective district under the supervision, direction, and control of the State * * * [department of health] to construct, maintain, and operate in said district a system of sewerage and drainage, or of sewage-disposal works, or both, with the necessary pipes, drains, conduits, fixtures, pumping works, and other appliances * * *. (Public Laws, 1900, p. 124.)

123. *Notice to cease pollution of waters.*—The State * * * [department of health] is hereby authorized and empowered to inspect any of the waters of this State, and if it finds that any of the waters of this State are being polluted in such manner as to cause or threaten injury to any of the inhabitants of this State, either in health, comfort, or property, it shall be its duty to notify, in writing, any person, municipal or private corporation found to be polluting said waters that prior to a time to be fixed by said * * * [department], which time shall not be more than five years from the date of said notice, said person or corporation must cease to pollute said waters and make such other disposition of the sewage or other polluting matter as shall be approved by said * * * [department]; any person or corporation aggrieved by any such finding may appeal therefrom to the court of chancery at any time within three months after being notified thereof, and the said court is hereby authorized and empowered to hear and determine such appeal in a summary manner, according to its course and practice in other cases, and thereupon to affirm, reverse, or modify the finding of said * * * [department] in such manner as it may deem just and reasonable. (Public Laws, 1907, p. 360).

124. *May apply for injunction.*—The State [department of health] is hereby authorized to apply to the court of chancery for writ of injunction to prevent any violation of or to enforce the provisions of this act and the act to which this is a supplement,[1] and it shall be the duty of the said court, in a summary way, to hear and determine the merits of said application; and in all such cases to restrain violation of or enforce the provisions of the said acts. (Public Laws, 1907, p. 361.)

125. *Meaning of "waters."*—"Waters of this State," as used in this act and the act to which this is a supplement, shall include the ocean and its estuaries, all springs, streams, and bodies or surface or ground water, whether natural or artificial, within the boundaries of this State or subject to its jurisdiction. (Public Laws, 1907, p. 361.)

127. *Duties vested in State sewerage commission performed by State board of health.*—From and after the passage and approval of this act all powers and duties heretofore vested in and executed by the State sewerage commission, pursuant to the act entitled "An act to prevent the pollution of the waters of this State by the establishment of a State sewerage commission, and authorizing the creation of sewerage districts and district sewerage boards, and prescribing, defining, and regulating the powers and duties of such commission and such boards," approved March 24, 1899, and the acts supplementary thereto and amendatory thereof,[2] shall vest in and be executed by the * * * [depart-

[1] Supplements law just quoted.

[2] See above secs. 86–91, 93–95, 105, 123–125, which are taken from this law and its supplements.

ment] of health of the State of New Jersey. (Public Laws, 1908, p. 695, as amended; Public Laws, 1909, p. 215.)

130. *Sewers and drainage commissioners.*—Upon the creation and incorporation by the legislature of any sewerage and drainage district for the purpose mentioned in the title of this act [of relieving the streams and rivers in sewage and drainage districts from pollution and to provide a plan for the prevention thereof and providing for the raising, expenditure, and payment of moneys necessary for this purpose] it shall be the duty of the governor of this State forthwith to appoint therein and therefor five able and discreet men, residents within such district * * * who when so appointed, commissioned, and sworn shall constitute a board of commissioners, to be known as the —— district sewerage and drainage commissioners * * *. (Public Laws, 1902, p. 195.)

133. *Powers and duties of commissioners as to investigations.*—When duly organized the said commissioners shall at once, with the aid and assistance of such engineers and other agents as they may deem proper, proceed to investigate methods and plans for relieving the streams and rivers within the said district from pollution and for preventing the pollution of the same and to determine the apportionment of the capacity of sewer provided for each municipality in any intercepting sewer, sewers, or disposal works: *Provided*, That before a final determination as to the plan or method to be adopted for the purpose an opportunity shall be given the governing body of each municipality to be heard in relation thereto, and after said hearing, as soon as the said commissioners have adopted a plan or method for this purpose, they shall report the same to the respective municipalities of the district and to the legislature of this State, together with a bill providing therefor and for the expenses thereof. (Public Laws, 1902, p. 197.)

139. *Exclusive control over prevention of pollution of waters.*—When the said board of commissioners are appointed and organized under this act it shall have absolute control of and supervision over the prevention of pollution throughout the said sewerage or drainage district for which the said commissioners were appointed, exclusive of any other body or board in this State now having control of the same * * *. (Public Laws, 1902, p. 199.)

140 (as amended by Public Laws, 1917, p. 502). *Discharge of sewage into certain portion of Passaic River prohibited.*—Every municipality, corporation, and individual is hereby prohibited and forbidden to discharge, directly or indirectly, any sewage or other polluting matter into the waters of the Passaic River or at any point between the Great Falls in the city of Paterson and the mouth of said river at Newark Bay or into any tributaries of the Passaic River which empty into the Passaic River between said points after the 31st day of December, in the year 1918; and the Passaic Valley sewerage commissioners are hereby authorized and empowered to enforce the provisions of this act over and throughout all municipalities which may, or the inhabitants of which may, directly or indirectly, discharge sewage or other polluting matter into the waters of the Passaic River between the points above designated or into the tributaries aforesaid, after the said 31st day of December, 1918.

The Passaic Valley sewerage commissioners are hereby authorized and directed, within 30 days after the approval of this act, to notify each municipality from which sewage or other polluting matter is or may be discharged into the said river between said points, either directly or indirectly, and the inhabitants thereof, that the discharge of sewage and other polluting matter into the waters of the said river must be discontinued on or before the 31st day of December, in the year 1918.

Such notice shall be in writing, signed by the president and secretary of Passaic Valley sewerage commissioners, and shall be served upon the clerk or the equivalent officer of every such municipality and shall be published in one of the newspapers printed and circulating in the counties of Passaic, Bergen, Hudson, and Essex for two consecutive weeks, once in each week, such public notice to be in the following form:

> *To whom it may concern:* Public notice is hereby given that the discharge of sewage and other polluting matter into the waters of the Passaic River at any point between the Great Falls, at the city of Paterson, and Newark Bay, and into the tributaries of said river emptying therein between said points is prohibited, and must cease and be discontinued after December 31st in the year 1918.

The Passaic Valley sewerage commissioners are further authorized and empowered to institute in their corporate name suits at law or in equity as may be deemed necessary or appropriate to enforce the provisions of this section of the act after said 31st day of December, in the year 1918, and the court of chancery of this State is hereby vested with special jurisdiction to enforce the provisions of this section of this act in a summary manner upon application of the Passaic Valley sewerage commissioners. (Public Laws, 1907, p. 22, as amended.)

141. *Construction of intercepting sewers to prevent pollution.*—The governing body or board having charge of finances of any municipality or municipalities, lying in whole or in part within the Passaic Valley sewerage district may, by resolution, determine that it is advisable and to the interest of such municipality or municipalities, in order to comply with the provisions of this act, to cause the sewage and other polluting matter discharging or which may be discharged into the waters of the Passaic River, from its or their territory, within the Passaic Valley sewerage district, to be intercepted by a trunk or main intercepting sewer or sewers, and to be conducted to a safe and proper place for discharge and disposal, and there to be discharged or disposed of. * * * (Public Laws, 1907, p. 24.)

142. *Maps and specifications to be prepared by the Passaic Valley sewerage commissioners.*—Upon receiving a copy of such resolution or resolutions * * * the Passaic Valley sewerage commissioners shall forthwith prepare * * * maps, plans, and specifications and estimates * * *. (Public Laws, 1907, p. 25.)

143. *Municipalities may enter into contracts for intercepting sewers.*—Any two or more of said municipalities, * * * are hereby authorized and empowered, by resolution of their governing bodies or boards having charge of their finances, to enter into a contract in writing with each other and with the Passaic Valley sewerage commissioners, in their corporate capacities, for the construction, maintenance, and operation of said sewer or sewers, plant, or works, with the appurtenances * * *. (Public Laws, 1907, p. 26.)

152. *Passaic Valley sewerage commissioners authorized to enter into contract with United States.*—The Passaic Valley sewerage commissioners are hereby authorized and empowered, for themselves and their successors, to enter into a stipulation and contract with the United States concerning the manner in which any sewer made or managed by said Passaic Valley sewerage commissioners and discharging into New York Bay shall be constructed, maintained, and operated, and concerning the character and effects of the sewage discharged by said sewer into New York Bay, and concerning the terms or conditions in reference to the construction, maintenance, operation, or effects of such sewer, which said Passaic Valley sewerage commissioners consent to have introduced into such permits as may be requisite under the statutes of the United States

for the construction, maintenance, or operation of said sewer; it being agreed in such contract on the part of the United States, through its Attorney General, that upon the execution of such stipulation and contract the United States will dismiss, or cause to be dismissed, its intervention in the suit above mentioned [suit in United States Supreme Court between people of the State of New York, complainants, and the State of New Jersey and the Passaic Valley sewerage commissioners, defendants], and will not again intervene in such suit. (Public Laws, 1910, p. 267.)

[PUBLIC LAWS, 1911, P. 485.]

SEC. 1. *Department of conservation and development to approve water supplies.*—It shall be lawful for the board of aldermen, common council, board of water commissioners, or other governing body of any municipal corporation in this State, owning or controlling waterworks, to enter into and make a contract or contracts with any municipal corporation in this State to furnish a supply of water for public or private use for the term of a year or years; provided there shall be first obtained the approval of the * * * [department of conservation and development], which approval and consent said * * * [department] may withhold or grant upon such terms as it may seem proper, but in case approval and consent are withheld, the reason for such withholding shall be furnished by said * * * [department] to the municipality applying therefor.

SEC. 2. *Term.*—Where said waterworks are under the control of a board of water commissioners, no contract shall be made for a term exceeding three years without the consent of the governing board of the city owning or controlling said waterworks.

[PUBLIC LAWS, 1911, P. 556.]

SEC. 13. *Putting poisonous substance into Delaware River and Bay.*—It shall be unlawful for any person to put or place in the Delaware River and Bay lying between the States of New Jersey and Delaware and any of the tributaries of said river and bay within said limits wherein the tide ebbs and flows, any * * * poisonous substances whatsoever, or any drug, or any poison bait for the purpose of catching, taking, killing, or injuring the fish, or to allow any dyestuff, coal or gas tar, coal oil, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime, vitriol, or any of the compounds thereof, refuse from gas houses, oil tanks, or vessels, or any deleterious, destructive or poisonous substances of any kind or character to be turned into or allowed to run, flow, wash, or be emptied into any of the waters aforesaid, unless it be shown that every practicable means has been used to prevent the pollution of waters in question by the escape of deleterious substances. In the case of the pollution of waters by substances known to be injurious to fishes, or to fish food, it shall not be necessary to prove that such substances have actually caused the death of any particular fish. Any person violating any of the provisions of this section shall, on conviction thereof, be subject to a fine of $200.

[PUBLIC LAWS, 1912, P. 16.]

SEC. 3. *Villages may protect water supply.*—The trustees [of any village] shall have the power and they are hereby authorized to make, ordain, and establish all such ordinances, resolutions, and regulations as said body may deem necessary and proper for the * * * protection of the said water [used for public and domestic use] * * *.

[PUBLIC LAWS, 1912, P. 26.]

SEC. 1. *Preservation of purity of water used by hatchery.*—It shall be unlawful for any person or corporation to put or place in any water used by a State fish hatchery any * * * poisonous substances whatever, or any drug or any poison bait, or to allow any dyestuff, coal or gas tar, coal oil, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime, vitriol, or any of the compounds thereof, refuse from gas houses, oil tanks, or tanneries, or any deleterious, destructive, or poisonous substances of any kind or character, to be turned into or allowed to run, flow, wash, or be emptied, or find its way, into any water used by a State fish hatchery, or to erect or maintain any privy, water-closet, pigsty, hogpen, inclosure for poultry, barn, or barnyard, in which animals or poultry are kept, or drain from any building or the cellars thereof, where drainage or refuse therefrom will find its way into water used by a State fish hatchery. In case of the pollution of water used by a State fish hatchery, by substances known to be injurious to fish or fish food, it shall not be necessary to prove that such substances have actually caused the death of any particular fish.

SEC. 2. *Penalty.*—Any person violating any of the provisions of this act shall, on conviction thereof, be subject to a penalty of $500.

[PUBLIC LAWS, 1912, P. 37.]

SEC. 13. *Placing poisonous substances in tidal tributaries of Delaware River between Trenton Falls and Birch Creek.*—(Section is identical with section 202, under "Fish and game," in the Compiled Statutes of 1910, except that it refers to those tributaries of the Delaware River between Trenton Falls and Birch Creek wherein the tide ebbs and flows.)

[PUBLIC LAWS, 1912, P. 44.]

SEC. 1. *State department of health to inspect oyster and clam beds.*—It shall be the duty of the * * * [Department] of Health of the State of New Jersey to inspect, or cause to be inspected, as often as said * * * [department] may deem necessary, the various oyster and clam beds and other places within the jurisdiction of or forming a part of the State of New Jersey from which oysters, clams, or other shellfish are taken to be distributed or sold for use as food for the purpose of ascertaining the sanitary conditions of such oyster and clam beds and other places, and the fitness of the oysters, clams, or other shellfish in such places or which are taken therefrom for use as food.

SEC. 2. *Beds dangerous to health condemned.*—If the State * * * [department] of health discovers that any oyster or clam bed or other place from which oysters, clams, or other shellfish are or may be taken for use as food is subject to pollution or to any other condition which may render the oysters, clams, or other shellfish in such places, or which may be taken therefrom, dangerous to health it shall be the duty of said * * * [department] to immediately condemn such oyster or clam bed or other place, and to prohibit the taking of oysters, clams, or other shellfish from such places for distribution or sale as food, and also to prohibit the sale, distribution, offering for sale, or having in possession with intent to distribute or sell any such oysters, clams, or other shellfish.

SEC. 3. *Evidence of use as food.*—For the purpose of this act the distribution, sale, offering for sale, or having in possession with intent to distribute or sell any oysters, clams, or other shellfish shall be prima facie evidence that such oysters, clams, or other shellfish were intended for use as food.

SEC. 4. *Polluting shellfish waters forbidden.*—No excremental or other polluting matter of any kind or character whatever shall be discharged into or placed in the waters, or placed or suffered to remain upon the banks of any stream or tributary thereof or body of water in which shellfish grow, or are or may be placed: *Provided, however*, That nothing in this section shall apply to the discharge of sewage or drainage into such stream, tributary, or body of water by municipalities of this State.

SEC. 5. *Regulations of State department of health.*—The State * * * [department] of health shall have power to adopt, promulgate, and enforce such rules and regulations as shall promote the purposes of this act, and * * * [it] shall also have power to make such specific orders regarding the growing and handling of shellfish and the disposal of polluting matter which may affect the purity of shellfish as * * * [it] may deem necessary to enforce the provisions of this act.

SEC. 8. *Penalty.*—Any person or corporation who shall violate any of the provisions of this act or any of the rules and regulations made under authority contained in this act, or who shall disobey any order made by the State * * * [department] of health under authority contained in section 5 of this act, or who shall gather with intent to distribute or sell for use as food any oysters, clams, or other shellfish from any oyster or clam bed or other place which has been condemned by the State * * * [department] of health in accordance with the provisions of section 2 of this act, or who shall distribute, sell, offer, or expose for sale or have in his possession for the purpose of sale any oysters, clams, or other shellfish taken from any oyster or clam bed or other place which has been condemned by said * * * [department], shall be liable to a penalty of $100, such penalty to be recovered in an action of debt by and in the name of the * * * [department] of health of the State of New Jersey as plaintiff. * * *

SEC. 10. *Violation may be enjoined.*—Whenever any person shall violate any of the provisions of this act, it shall be lawful for the * * * [department] of health of the State of New Jersey, either before or after the institution of proceedings for the collection of the penalty imposed by this act for such violation, to file a bill in the court of chancery in the name of the State, at the relation of said board, for an injunction to restrain such violation and for such other and further relief in the premises as the court of chancery shall deem proper, but the filing of such a bill, nor any of the proceedings thereon, shall not relieve any party of such proceedings from the penalty prescribed by this act for such violation.

[PUBLIC LAWS, 1912, P. 557.]

SECTION 1 (as amended by Public Laws, 1913, p. 206).—*Department of conservation and development may acquire lands, water rights, etc., to conserve potable waters of State.*—The * * * [department of conservation and development] as a body corporate shall have power to acquire by gift, purchase, condemnation, or in any other lawful manner, any lands, water rights, and interests therein, whenever in its judgment it is advisable so to do, for the purpose of appropriating or conserving the potable waters of the State to the general and common use of the inhabitants thereof. * * *

SEC. 4. *Powers are additional—Governor's consent necessary.*—The powers herein conferred on the State * * * [department of conservation and development] are in addition to and not in limitation of any powers or authority heretofore conferred upon it, but shall only be exercised when consented to by the governor of the State of New Jersey, and no contract, obligation, bond, or mortgage executed in pursuance of the provisions hereof shall be valid unless

the governor of the State of New Jersey shall consent to the same, and every such contract, obligation, bond, or mortgage shall be subject to review by the supreme court as to the reasonableness and fairness of the terms and conditions thereof.

[PUBLIC LAWS, 1914, P. 550.]

SECTION 1. *Municipalities may protect water supply by paying toward sewer built by another municipality.*—In cities and other municipalities of this State having a public water supply derived from sources beyond the city limits, whenever it has become or may become necessary to protect such water from pollution, it shall be lawful for the common council, board of aldermen, or other governing body of said city or other municipality to pay to any municipality through which said water flows a portion of the cost toward the construction of a system of sewers in any such municipality: *Provided*, That the plans for said systems of sewers in any such municipality shall first have been approved by the State * * * [department] of health.

[PUBLIC LAWS, 1915, P. 426.]

SECTION 1. *Department of conservation and development established.*—A department of conservation and development is hereby established, and the same shall be governed by a board to be known as the "board of conservation and development."

SEC. 5. *Succeeds State water supply commission.*—The board of conservation and development shall succeed to and exercise all the rights and powers and perform all the duties now exercised and performed by or conferred and charged upon the State water supply commission * * *.

SEC. 13. *Same.*—Whenever, in any act, the words the "State water supply commission" * * * are used, the same shall be taken to be and to mean the board of conservation and development.

[PUBLIC LAWS, 1915, P. 517.]

SECTION 1. *Department of health established.*—The department of health is hereby established, and the same shall be governed by a board of eight members to be known as the "department of health of the State of New Jersey." * * *

SEC. 4. *Powers and duties.*—The powers and duties of the department of health of the State of New Jersey shall be as follows:

(*a*) It shall exercise all the powers and perform all the duties now exercised and performed by or conferred and charged upon the board of health of the State of New Jersey.

(*c*) It shall enact a State sanitary code which shall contain such rules and regulations, the observance of which in its opinion will promote health and prevent disease. * * *

SEC. 6. *Sanitary code to have force of law.*—The provisions of the sanitary code shall have the force and effect of law, and any violation of any portion thereof shall be punishable by a penalty of not less than $25 nor more than $100, to be sued for and recovered by the director of health or by the local health officer, local board of health, or other board or officer exercising the powers of a local board of health of any local jurisdiction within which such violations may occur * * *.

[PUBLIC LAWS, 1916, P. 128.]

SECTION 1. *State divided into two water-supply districts.*—The State of New Jersey * * * [is hereby] divided into two districts for the purposes of

municipal water supplies, one of which shall be known as the North Jersey water-supply district and the other as the South Jersey water-supply district. The North Jersey water-supply district shall consist of the counties of Sussex, Warren, Hunterdan, Passaic, Morris, Somerset, Bergen, Hudson, Essex, Union, and Middlesex, and the South Jersey water-supply district shall consist of the remaining counties of the State. Each of said districts shall be entitled to all of the authority and shall be subject to all the laws of this State concerning water districts so created.

[PUBLIC LAWS, 1916, P. 129.]

SECTION 1. *Commission to be appointed for two water-supply districts.*—There shall be appointed in the manner hereinafter provided a water-supply commission for each of the water-supply districts created by * * * [Public Laws, 1916, p. 128].

SEC. 2. *Membership.*—Each of said commissions shall consist of four members, who shall be residents of the water-supply district which they represent * * *.

SEC. 3. *Municipalities may ask for district water-supply commission.*—The body having charge of the water supply in any municipality of this State may, by resolution, determine that it is in the interests of said municipality that a district water-supply commission be appointed for the water-supply district wherein such municipality is located for the purpose of developing, acquiring, and operating a water supply or a new or additional water supply, for the use of said municipality and such other municipalities as may be authorized to join with it according to the terms of this act, and that a petition be presented to the governor of the State of New Jersey praying for the appointment of such a commission and setting forth in general terms the location and character of the water supply desired. The governor shall thereupon, within 30 days, appoint four residents of said water-supply district as such commissioners * * *.

SEC. 5. *Petition for water supply.*—The board having charge of the water supply of any municipality in a water-supply district for which a commission has been appointed as hereinbefore provided may, by resolution, petition the said commission for a water supply or a new or additional water supply * * *.

SEC. 6. *Hearing on proposition.*—Upon the filing of such petition the said district water-supply commission, after obtaining the consent of the State * * * [department of conservation and development] * * * shall fix a time and place for a public hearing upon said application * * *.

SEC. 7. *Other municipalities may join.*—Upon said hearing any municipality appearing may signify its desire to acquire an existing water supply or to obtain a new or additional water supply * * *.

SEC. 8. *Plans, estimates, etc.*—The said district water-supply commission shall thereupon proceed to formulate plans for obtaining a water supply or a new or additional water supply for said municipality and any other municipalities that may desire water from such joint water supply * * *.

SEC. 9. *Hearing on preliminary report; acceptance of contract.*—After the said district water-supply commission has submitted its preliminary report and form of contract to the municipalities interested, it shall notify said municipalities of a time and place for a hearing by such municipalities upon such contracts, respectively. At said hearing each municipality shall, through the board or body having charge of its water supply, signify its willingness to accept the terms of said contract as presented, or present such modifications for the consideration of said district water-supply commission as it may desire, or withdraw from further participation in the proposed water-supply development.

SEC. 10. *Final form of contract.*—After said hearing, said district water-supply commission shall present a final form of contract to be executed between the said commisison and each of the municipalities which, at such hearing, shall signify its desire to participate in such water supply. * * *

SEC. 11. *Carrying out contract.*—When said contract or contracts are signed * * * the said district water-supply commission shall forthwith proceed to carry out the same. * * *

SEC. 17. *Control after completion.*—Upon the completion of such water-supply plant and works and appurtenances, the said district water-supply commission is authorized and directed to retain and have the sole control and charge of the said water-supply plants and works and appurtenances, except such part of the same as the said commission may convey to any one of the contracting municipalities * * *.

SEC. 20. *No state indebtedness.*—Nothing in this act contained shall be construed to authorize any district water-supply commission to incur any indebtedness on behalf of the State of New Jersey.

SEC. 22. *Powers granted to district water-supply commission in this act taken from State department of health.*—All acts and parts of acts heretofore passed inconsistent with the terms and provisions of this act or granting to the * * * [State department of health] the powers in this act granted to the boards of district water-supply commissions, when created as herein provided are hereby repealed * * *.

[PROHIBITION OF NUISANCES. REG. DEPT. OF H., MAY 2, 1916.]

REGULATION 1. No person or private or municipal corporation shall maintain or permit to be maintained anything whatsoever which is a hazard or a danger to human health.

REG. 2. No person or private or municipal corporation shall maintain any well or other supply of water used for drinking or household purposes which is polluted in any manner that may render such water injurious to health, or which is so situated or constructed that it may become so polluted.

REG. 3. No person or private or municipal corporation shall maintain, use, or permit to be used any privy or other receptacle for human excrement unless such privy or other receptacle is so constructed and maintained that flies can not gain access to the excremental matter contained therein and unless such excremental matter shall at all times be prevented from flowing over or upon the surface of the ground. Every privy or other receptacle for human excrement located within 100 feet of any stream, the waters of which are used for drinking or domestic purposes, shall be provided with a water-tight vault.

REG. 4. No person or private or municipal corporation shall permit any human excrement, or material containing human excrement, to remain in the surface of the ground; nor shall such excremental matter or material containing such excremental matter be buried or otherwise disposed of within 100 feet of any stream, well, lake, spring, or other source of water used for drinking or domestic purposes; nor shall any such material be deposited in any place where it is likely to gain access to such waters: *Provided, however*, That this regulation shall not apply to effluents from sewage disposal plants which have been or hereafter may be approved by the State department of health.

REG. 5. No person or private or municipal corporation shall maintain or permit to be maintained any accumulation of decomposing animal or vegetable matter in which fly larvæ exist on any premises upon which is located any hotel, boarding house, lodging house, restaurant, or any other establishment in which

foods intended for sale or distribution are prepared, handled, or sold, or at any point on any other premises within 250 feet of any dwelling occupied by another.

REG. 6. No person or private or municipal corporation shall maintain or permit to be maintained any pool, pond, ditch, stream, or other body of water, or any cistern, privy vault, cesspool, rain barrel, or other receptacle containing water in which mosquito larvæ exist.

REG. 7. These regulations shall take effect on June 1, 1916.

NEW MEXICO.

[STATUTES ANNOTATED, CODIFICATION, 1915.]

564. *Bodies not to be buried near stream.*—It shall be unlawful in the State of New Mexico for any person or persons, or for any order or society of persons, or for any corporation or corporations, to bury or inter their dead, or use any land or lands in any way whatsoever as a burial place or a place of interment for such dead within 50 yards from either side of the bank or border of any stream or streams or any river or rivers of running water.

565. *Penalty.*—Any person or persons guilty of violation of the provisions of the preceding section shall on complaint and conviction thereof, for each and every offense so committed, be subject to a fine of not less than $50 and not more than $500 or imprisonment in the county jail, not less than 60 days and not more than six months, or both; one-half of all fines so collected shall be given to the informant and the balance shall be turned over to the county treasurer.

1482. *Poisoning springs, etc.*—If any person * * * shall willfully poison any spring, well, or reservoir of water, with such intent [that of killing or injuring any other person], he shall be punished by imprisonment in the State penitentiary for life.

1583. *Penalty for bathing in or polluting reservoirs, etc.*—Any person who shall bathe in, or willfully cast any filth in, any reservoir used for supplying water for domestic use shall be guilty of a misdemeanor, and upon conviction shall be fined not less than $10 or not more than $25.

1741. *Depositing filth near stream.*—It shall be unlawful for any person or persons, to cast, throw out or deposit any offal, refuse matter, putrid or deleterious substance, or the dead body or carcass of any animal, * * * within 500 yards of any well, spring, acequia or ditch, or any arroyo, creek or stream of water used for drinking purposes, and any person or persons violating any of the provisions of this section shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined in any sum not less than $3 nor more than $80.

1742. *Pollution of streams, etc.*—It is hereby made unlawful for any person to cast the dead body of any animal or fowl, or any refuse matter, such as tin cans, paper, ashes, bones, or other garbage into any running stream, spring, lake, pond, reservoir, ditch, or watercourse, or to run or empty any sewer or other foul substance into the same, or in any other manner or means to pollute or foul the said water so as to render the same offensive or dangerous to the health of the inhabitants of any community or of any person having the right to use the same for drinking or domestic purposes, or that may render said waters unfit or unhealthy for watering stock. But it shall be the duty of every person outside of incorporated towns, cities, or villages to destroy all domestic refuse and garbage by burning the same; any violation of this section shall be considered a misdemeanor and punished as provided by law.

1743. *Pollution in above manner termed a nuisance.*—The polluting of waters in any of the manners specified in the foregoing section is hereby declared to be a public nuisance, which shall be immediately removed by the person or persons[1] creating the same, upon the demand of any public officer or of any person or persons who may have a right to the use of said waters.

1744. *Penalty.*—Any person or persons violating any of the provisions of section 1742 may be tried therefor before any justice of the peace of the county where the offense is committed, and upon conviction thereof shall be punished by a fine in any sum not less than $10 nor more than $100, or by imprisonment in the county jail for any period of time not less than 10 days nor more than 60 days, or by both fine and imprisonment. And in addition thereto the justice of the peace shall direct the sheriff of the county or the constable of the precinct to remove such nuisance, at the expense of the person or persons creating the same, which said expenses shall be taxed as other costs against the person or persons so offending, and shall be collected in the manner provided by law for the collection of costs in criminal cases.

2428. *Pollution of water by sawmills—poisoning fish.*—It shall be unlawful for the owner or owners of any sawmill, or any of the employees thereof, or any other person or persons whomsoever, to deposit, throw, or in any way permit to pass into any natural stream, or any lake wherein are living fish, any sawdust, or any other substance that will or may tend to the destruction or driving away of any such fish from any such water; and it shall be unlawful to use for the killing or catching of any fish any poisonous, deleterious, or stupefying drug, * * * at any time; and every person violating any of the provisions of this section shall upon conviction thereof be punished by a fine of not less than $50 nor more than $150, or by imprisonment for not less than three months nor more than one year, or by both such fine and imprisonment.

3564. *Council's power to prevent pollution of water supply.*—The city council and board of trustees in towns shall have the following powers:

Sixty-ninth. Cities and towns shall have power to construct or authorize the construction of such water works, without their limits, and, for the purpose of maintaining and protecting the same from injury and the water from pollution, their jurisdiction shall extend over the territory occupied by such works, and all reservoirs, streams, trenches, pipes, and drains used in and necessary for the construction, maintenance, and operation of the same, and over the stream or source from which the water is taken, for 5 miles above the point from which it is taken, and to enact all ordinances and regulations necessary to carry the power herein conferred into effect.

3756. *Preventing pollution of water in towns and villages.*—They [towns and villages] shall have the power, by ordinance, to provide a supply of water by the construction and regulation of wells, pumps, reservoirs, ditches, and to prevent the unnecessary waste and spreading or pollution of water within the corporate limits, * * * and they may go beyond their corporate limits and prevent or punish any pollution or fouling or injury to the stream or source of water which is supplied to said town.

4595. *Regulations of New Mexico Board of Health.*—The board of health [State] shall make such regulations respecting nuisances, sources of filth, and causes of sickness, applicable to any county, city, town, or village in the State or any part of any such county, city, town, or village, as the peculiar conditions in such county, city, town, or village may in the judgment of said board of health at any time require.

[1] Text reads "person or person."

4621. *Violations of regulations.*—Any person violating any of the provisions of * * * [sec. 4595] or any of the rules and regulations adopted by said board [State board of health], if punishment for the same is not otherwise provided for in this article, shall be guilty of a misdemeanor and after conviction shall be punished by a fine of not less than $25 and not more than $100, and may be prosecuted either by indictment or information or before any justice of the peace in the county in which such offense is committed.

NEW YORK.

[CONSERVATION LAW; CHAP. 647, LAW OF 1911.]

2 (as amended by Laws of 1917, chap. 486). *Conservation department.*—The conservation department is hereby created and shall have three divisions. The department shall continue to be in charge of a commission to be known as the conservation commission * * *.

4 (as amended by Laws of 1915, chap. 318). *Division of waters and division of fish and game.*—There shall be in the department * * * a division of waters under which shall be administered all laws relating to State jurisdiction over water storage and hydraulic development, water supply, river improvement, drainage, irrigation and navigation of waters outside the canals and a division of fish and game under which shall be administered all laws relating to State jurisdiction over fish and game and for the propagation thereof, including shellfish. * * * The division engineer shall be the chief and administrative head of the division of waters. The chief game protector shall be the chief and administrative head of the division of fish and game.

21. *Commission to investigate water resources with reference to water supply.*—It shall be the duty of the commission to continue investigations of the water resources of the State, including the systematic gaging of rainfall and stream flow throughout the State, so as to complete a comprehensive system for the entire State, for the conservation, development, regulation, and use of the waters in each of the principal watersheds of the State with reference to the accomplishment of the following public uses and purposes:

1. The prevention of floods and the protection of the public health and safety in the watershed.

2. The supply of pure and wholesome water from the watershed to municipalities and the inhabitants thereof and the disposal of sewage.

(3–5 relate to drainage, irrigation, water power, and navigation.)

182 (as amended by Laws of 1916, chap. 521). *Penalties.*—* * * (3) A person who violates any of the provisions of sections * * * 247 or 248 thereof shall be guilty of a misdemeanor, and in addition thereto is liable as follows: To a penalty of $500 and an additional penalty of $10 for each fish taken, killed, or possessed in violation thereof.

247 (added by laws of 1912, chap. 318, and amended by Laws of 1913, chap. 508). *Pollution of streams by trade wastes prohibited.*—No dyestuffs, coal tar, refuse from a gas house, cheese factory, creamery, condensery, or canning factory, sawdust, shavings, tan bark, lime, or other deleterious or poisonous substance shall be thrown or allowed to run into any waters, either private or public, in quantities injurious to fish life inhabiting the same or injurious to the propagation of fish therein.

248 (added by Laws of 1912, chap. 318). *Pollution of waters used by State fish hatcheries prohibited.*—No person shall erect or maintain any privy, water-closet, pigsty, hogpen, inclosure for poultry, barn or barnyard in which animals or poultry are kept, or drain from any building or the cellar thereof,

where drainage or refuse therefrom will flow into or find its way into water used by any fish hatchery operated by the State, or into any pond, creek, or stream used in connection therewith. Every such privy, water-closet, pigsty, hogpen, inclosure, barn, barnyard, and drain is hereby declared to be a public nuisance and may be summarily abated by the commission. No person shall place sewage or other matter injurious to fish where the same can find its way into water used by any fish hatchery operated by the State or suffer the same to be done from, over, or through premises owned or occupied by him.

310, subdivision 1 (as amended by Laws of 1913, chap. 796). *Sanitary inspection of shellfish grounds.*—It shall be the duty of the supervisor within one year from the passage of this act, or within such further time as it may require to complete the same and annually thereafter, to cause to be inspected and examined by a competent bacteriologist, appointed by the commission, all shellfish grounds and other places within the State from which shellfish are taken, planted, cultivated, or handled, with a view to ascertaining the sanitary condition of such shellfish grounds and other places, and the fitness of the shellfish in such places, or which may be taken therefrom, for use as articles of food, except that shellfish grounds used exclusively for the growing or cultivating of seed oysters shall not be subject to the sanitary examination and inspection provided for * * * [above].[1]

325 (added by Laws of 1912, chap. 318). *Pollution of water by manufactories.*—Sludge, acid, or refuse from oil works, sugar houses, or other manufactories, except refuse from the manufacture of oil from menhaden or other fish, sewage or any substance injurious to oyster culture or fish, shall not be placed or allowed to run into waters of the State in the marine district, and upon it appearing to the satisfaction of the supervisor that oyster beds or such waters have become polluted from one or more of these causes, it shall be his duty to cause complaint to be made in a criminal action against the person or persons so offending, and such person or persons so offending shall also be liable in damages to persons injured, in addition to the penalties hereinafter provided.

326 (added by Laws of 1912, chap. 318). *Garbage not to be thrown into certain waters.*—Garbage, cinders, ashes, oils, acids, sludge, or refuse of any kind shall not be thrown, dumped, or permitted to run, from any vessel into any bay or harbor, or into Long Island Sound within 2 miles of the shore west of a line drawn from Old Field Point due north to the boundary line between New York and Connecticut.

520. *General powers of commission in relation to water supply.*—The commission shall have the powers and perform the duties in relation to the supply of potable waters for the various municipalities, civil divisions and inhabitants of the State, set forth in this article [art. 9, water supply], and as may be further provided by law.

521. *Commission to approve plans for waterworks.*—No municipal corporation or other civil division of the State, and no board, commission, or other body of or for any such municipal corporation or other civil division of the State shall, nor shall any person or waterworks corporation engaged in supplying or proposing to supply the inhabitants of any municipal corporation or other civil division of the State with water, after this chapter takes effect, have any power to acquire, or to take a water supply or an additional water supply, or to take or condemn lands for any new or additional sources of water supply, until such person, corporation, or civil division has first submitted

[1] It seems unnecessary to quote further from the laws relating to sanitary condition of shellfish.

the maps, plans, and profiles therefor to the commission of conservation, as hereinafter provided,[1] and until said commission shall have approved the same, or approved the same with such modifications as it may determine to be necessary, as hereafter provided. Approval shall not be necessary * * * of any plans or work for the extension of supply or distributing mains or pipes of a municipal water-supply plant into and for the purpose of supplying water in any territory within the limits of the municipality owning such plant, including territory which has not been heretofore supplied with water by such plant.

523. *Approval of work.*—No new water-supply system, built in accordance with plans hereafter approved by the commission, shall be operated until the work has been approved by it.

525. *Sewage disposal as affecting potable waters.*—The commission shall report the present disposition of sewage of each municipal corporation and other civil division of the State, and, if necessary, of adjoining States, with special reference to said disposition affecting the various municipal corporations and other civil divisions of the State in relation to the water supply of this State. Said commission shall also report the advisability of, the time required for, and the expenses incident to, the construction of a State system of water supply and for a State system for the disposition of sewage, if necessary, for all or any of the municipal corporations and other civil divisions of this State, and make such recommendations connected with the subjects of said investigations herein provided for as said commission shall determine. In said investigation concerning either the water supply or disposition of sewage, said commission shall, so far as possible, make use of all reports and surveys in regard thereto which have heretofore been made. Wherever, by any provision of law, the consent or approval of any State board, officer, or commission is required for the construction of any sewage system or sewage disposal works, the further approval thereof by the conservation commission shall be required.

[NAVIGATION LAW; CONSOLIDATED LAWS, 1909, CHAP. 37.]

52 (as amended by Laws of 1915, chap. 402). *Deposit of dead animals or refuse in Lake George prohibited.*—No person or persons shall drain, deposit, or cast any dead animal, carrion, offal, excrement, garbage, or other putrid or offensive matter into the waters of Lake George or Schroon Lake in this State * * *. This section shall not be construed to prevent the deposit of the usual waste or drainage from factories, * * *. Every person violating any provision of this section shall be guilty of a misdemeanor punishable by a fine of $100, or by imprisonment in a penitentiary or county jail for not more than two months, or by both, in the discretion of the court, for each offense, and the district attorney of the county in which the offense is committed or exists, is authorized and directed to prosecute the offender or offenders hereunder and directed to pay the fine or fines collected to the treasurer of the county in which the offense is committed or exists, to be applied in reduction of the annual county taxes. * * *

53. *Deposit of dead animals and refuse in the St. Lawrence River.*—No person shall throw or cast any dead animal, carrion, or offal, or other putrid or offensive matter in the waters of the St. Lawrence River within the jurisdiction of this State; * * *. Every person violating any provision of this section shall forfeit to the people of the State the sum of $50 for every such violation and shall be liable to the owner and occupant of any premises injuriously affected by such violation for all damages sustained thereby.

[1] Refer to Law (Cumulative Supplement 1910–1913, to Consolidated Laws, p. 423) for further details of procedure.

55. *Deposits in Racket River, etc.*—No corporation, company, person, or persons shall deposit or put into the Racket, Oswegatchie, or East Branch of the St. Regis Rivers, in this State, any buttings, edgings, slabs, or other débris except sawdust and planer shavings from any mills engaged in the manufacture of shingles, wood, or lumber upon or adjacent to such rivers to be floated down the same. Every person violating any provision of this section shall forfeit for every such violation the sum of $50, to be sued for and recovered by any person aggrieved thereby for his own use and benefit.

[PENAL LAW; CONSOLIDATED LAWS, 1909, CHAP. 40.]

1425. *Malicious injury of ice prohibited.*—A person who willfully:

7. Maliciously injures any ice upon any water from which ice is taken as an article of merchandise with intent to injure the owner thereof, or enters or skates upon any pond or body of water not navigable, kept and used for the purpose of taking ice therefrom as an article of merchandise, and upon or adjoining which a notice has been placed in a conspicuous position forbidding such entry, and stating the purpose for which said body of water is kept or used, or puts or throws upon or into any such pond or body of water any stick, stone, or other substance to the injury of the ice or water;

15. * * *. Shall be deemed guilty of a misdemeanor.

29. *Violation of statute which imposes no penalty is a misdemeanor.*—Where the performance of any act is prohibited by a statute, and no penalty for the violation of such statute is imposed in any statute the doing such act is a misdemeanor.

1740. *Willful violation of health laws.* * * * (2) A person who willfully violates any provision of the health laws, or any regulation lawfully made or established by any public officer or board under authority of the health laws, the punishment for violating which is not otherwise prescribed by those laws, or by this chapter [Penal Law, public-health chapter], is punished by imprisonment not exceeding one year, or by a fine not exceeding $2,000, or by both.

1754. *Putting noisome or unwholesome substances along water route.*—A person who deposits, leaves, or keeps, on or near a highway or route of public travel, either on the land or on the water, any noisome or unwholesome substance; or establishes, maintains,[1] or carries on, upon or near a public highway or route of public travel, either on the land or on the water, any business, trade or manufacture, which is noisome or detrimental to public health, is guilty of a misdemeanor, punishable by a fine of not less than $100, or by imprisonment not less than three nor more than six months, or both.

1758. *Contamination of salt wells.*—A person who willfully places, introduces, or causes to flow or enter into any spring, brook or body of water, which is used in the manufacture of salt, or into any salt well, or salt mine, or into any cavity or reservoir beneath the surface of the earth from which salt or brine is taken or used in the manufacture of salt, any impure or deleterious substance or thing whatsoever, which is liable to pollute the waters thereof, or the brine or salt taken or manufactured therefrom, provided that this act shall not interfere with any existing system of drainage or sewerage, is punishable by imprisonment in a penitentiary or State prison for not more than five years or by a fine of not more than $2,000, or by both such fine and imprisonment.

1759. *Befouling public waters with gas tar.*—A person who throws or deposits gas tar, or the refuse of a gas house or gas factory, or offal, refuse, or any other noxious, offensive, or poisonous substance into any public waters, or into

[1] Text reads "maintain."

any sewer or stream running or entering into such public waters, is guilty of a misdemeanor.

1760. *Poisoning water supplies.*—* * * A person who willfully poisons any spring, well or reservoir of water, is punishable by imprisonment in a State prison not exceeding 10 years, or in a county jail not exceeding one year, or by a fine not exceeding $500, or both such fine and imprisonment.

1937. *Punishment of misdemeanors when not fixed by statute.*—A person convicted of a crime declared to be a misdemeanor, for which no other punishment is especially prescribed by this chapter, or by any other statutory provision in force at the time of the conviction and sentence, is punishable by imprisonment in a penitentiary, or county jail, for not more than one year, or by a fine of not more than $500, or by both.

[PUBLIC HEALTH LAW; CONSOLIDATED LAWS, 1909, CHAP. 45.]

2b (added by Laws of 1913, chap. 559). *Sanitary code.*—The public-health council shall have power by the affirmative vote of a majority of its members to establish and from time to time amend sanitary regulations, hereinafter called the sanitary code, without discrimination against any licensed physicians. The sanitary code may deal with any matters affecting the security of life or health or the preservation and improvement of public health in the State of New York, and with any matters as to which jurisdiction is hereinafter conferred upon the public health council. * * * The provisions of the sanitary code shall have the force and effect of law and any violation of any portion thereof may be declared to be a misdemeanor. No provision of the sanitary code shall relate to the city of New York or any portion thereof, and every provision of the sanitary code shall apply to and be effective in all portions of the State except the City of New York unless stated otherwise.

2c (added by Laws of 1913, chap. 559). *Enforcement of sanitary code.*—The provisions of the sanitary code shall, as to matters to which it relates, and in the territory prescribed therefor by the public health council, supersede all local ordinances heretofore or hereafter enacted inconsistent therewith. * * *.

The actions, proceedings, and authority of the State health department in enforcing the provisions of the public health law and sanitary code applying them to specific cases shall at all times be regarded as in their nature judicial, and shall be treated as prima facie just and legal. All meetings of said public health council shall in every suit and proceeding be taken to have been duly called and regularly held, and all regulations and proceedings to have been duly authorized unless the contrary be proved. * * *

17 (added by Laws of 1915, chap. 384, and amended by Laws of 1916, chap. 372). *Violation of health laws or regulations.*—Any person violating, disobeying, or disregarding the terms of any lawful notice, order, or regulation prescribed by the State commissioner of health or by the sanitary code, or any provision of the public health law or sanitary code, for which a civil penalty is not otherwise expressly prescribed by law, shall be liable to the people of the State for a civil penalty of not to exceed $50, for every such violation. The said penalty may be recovered by an action brought by the State commissioner of health in any court of competent jurisdiction. Nothing in this section contained shall be construed to alter or repeal any existing provision of law declaring such violations or any of them misdemeanors or felonies or prescribing the penalty therefor.

70 (as amended by Laws of 1915, chap. 665). *Regulations in regard to protection of potable waters from contamination.*—The State department of health may make rules and regulations for the protection from contamination of any

or all public supplies of potable waters and their sources within the State, and the commissioner of water supply, gas, and electricity of the city of New York, and the board of water supply of the city of New York may make such rules and regulations, subject to the approval of the State department of health, for the protection from contamination of any or all public supplies of potable waters and their sources within the State where the same constitute a part of the source of the public water supply of said city. If any such rule or regulation relates to a temporary source or act of contamination, any person violating such rule or regulation shall be liable to prosecution for misdemeanor for every such violation, and on conviction shall be punished by a fine not exceeding $200, or imprisonment not exceeding one year, or both. If any such rule or regulation relates to a permanent source or act of contamination, said department may impose penalties for the violation thereof or the noncompliance therewith, not exceeding $200 for every such violation or noncompliance. Every such rule or regulation shall be published at least once in each week for six consecutive weeks, in at least one newspaper of the county where the waters to which it relates are located. The cost of such publication shall be paid by the corporation or municipality benefited by the protection of the water supply, to which the rule or regulation published relates. * * *

71 (as amended by Laws of 1915, chap. 665). *Inspection of water.*—The officer or board having by law the management and control of the potable water supply of any municipality, and in the city of New York, the commissioner of water supply, gas, and electricity, and the board of water supply of the city of New York, or the corporation furnishing such supply, may make such inspection of the sources of such water supply as such officer, board, or corporation deems advisable and to ascertain whether the rules or regulations of the State department and of the commissioner of water supply, gas, and electricity of the city of New York, and of the board of water supply of the city of New York, are complied with, and shall make such regular or special inspections as the State commissioner of health, or the commissioner of the department of water supply, gas, and electricity of the city of New York, or the board of water supply of the city of New York, may prescribe. If any such inspection discloses a violation of any such rule or regulation relating to a temporary or permanent source or act of contamination, such officer, board or corporation shall cause a copy of the rule or regulation violated to be served upon the person violating the same, with a notice of such violation. If the person served does not immediately comply with the rule or regulation violated, such officer, board, or corporation, except in a case concerning the violation of a rule or regulation relating to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, shall notify the State department of the violation, which shall immediately examine into such violation; and if such person is found by the State department to have actually violated such rule or regulation, the commissioner of health shall order the local board of health of such municipality wherein the violation or noncompliance occurs, to convene and enforce obedience to such rule or regulation.

If the local board fails to enforce such order within 10 days after its receipt, the corporation furnishing such water supply or the municipality deriving its water supply from the waters to which rule or regulation relates, or the State commissioner of health or the local board of health of the municipality wherein the water supply protected by these rules is used, or any person interested in the protection of the purity of the water supply, may maintain an action in a court of record which shall be tried in the county where the cause of action arose against such person, for the recovery of the penalties incurred by such violation, and for an injunction restraining him from the continued violation

of such rule or regulation. If the person served does not comply within five days with the rule or regulation violated, in case such rule or regulation relates to a temporary or permanent source or act of contamination affecting the potable water supply of the city of New York, the commissioner of water supply, gas, and electricity of said city, or the board of water supply of the city of New York, may summarily enforce compliance with such rule or regulation, and may summarily abate or remove the cause of the violation of such rule or regulation or the nuisance so created, and to that end may employ such force as may be necessary and proper: *Provided, however*, That no building or improvements shall be removed, disturbed, or destroyed by the said commissioner of water supply, or the said board of water supply, until he or they shall cause measurements to be made of the buildings and photographs of the exterior views thereof, which measurements and photographs shall be at the disposition thereafter of the owners or their attorneys, and failure to exercise such right of abatement shall not be deemed a waiver thereof. Failure to comply within five days with such rule and regulation shall further entitle the city of New York to maintain an action in any court having jurisdiction thereof for the recovery of the penalties incurred by such violation and for an injunction restraining the person or persons violating such rule or regulation, or creating or continuing such nuisance, from the continued violation of such rule or regulation or continuance of such nuisance, the remedy by abatement being not exclusive.

73 (as amended by Laws of 1915, chap. 665). *Municipality or corporation owning water works benefited must make improvements in water works or sewage-disposal plants.*—When the State department of health, or the commissioner of water supply, gas, and electricity of the city of New York, or the board of water supply of the city of New York, shall, for the protection of a water supply from contamination, make orders or regulations the execution of which will require or make necessary the construction and maintenance of any system of sewage, or a change thereof, in or for any village or hamlet, whether incorporated or unincorporated, or the execution of which will require the providing of some public means of removal or purification of sewage, the municipality or corporation owning the water works benefited thereby shall, at its own expense, construct and maintain such system of sewage, or change thereof, and provide and maintain such means of removal and purification of sewage and such works or means of sewage disposal as shall be approved by the State department of health, and for that purpose said municipality or corporation may acquire, under the general condemnation law, the necessary real estate or interest therein whether now used for public or private purposes. When the execution of any such regulations of the State department of health, or the commissioner of water supply, gas, and electricity of the city of New York, or the board of water supply of the city of New York, will occasion or require the removal of any building or buildings, the municipality or corporation owning the water works benefited thereby shall, at its own expense, remove such buildings and pay to the owner thereof all damages occasioned by such removal. When the execution of any such regulation will injuriously affect any property the municipality or corporation owning the water works benefited thereby shall make just and adequate compensation for the property so taken or injured and for all injuries caused to the legitimate use or operation of such property. Until such construction or change of such system or systems of sewerage, and the providing of such means of removal or purification of sewage, and until such works or means of sewage disposal and the removal of any building are so made by the municipality or corporation owning the water works to be benefited thereby at its own expense, and until, except in the case of a municipality, the corporation owning the water works benefited shall make just and

adequate payment for all injuries to property and for all injuries caused to the legitimate use or operation of such property, there shall be no action or proceeding taken by any such municipality, officer, board, person, or corporation against any person or corporation for the violation of any regulation of the State department of health under this article [Art. V, "Potable Waters"], and no person or corporation shall be considered to have violated or refused to obey any such rule or regulation. * * *

73a (added by Laws of 1915, chap. 665). *Limitation of sanitary control of board of water supply of New York City.*—Nothing contained in this chapter [chap. 45, public health law] shall extend the sanitary control of the board of water supply of the city of New York, beyond the sources of potable water supply, tributary to the Catskill Aqueduct; and the powers granted by this chapter to the board of water supply of the city of New York shall cease at the time of the transference of the jurisdiction over the source of water supply, by the board of water supply to the commissioner of water supply, gas, and electricity of the city of New York; and at no time shall the commissioner of water supply, gas, and electricity of the city of New York and the board of water supply of said city have or exercise concurrent powers or sanitary control over the sources of potable water supply tributary to the Catskill Aqueduct.

74. *Discharge of sewage into Wallkill Creek prohibited.*—No person or corporation shall permit the discharge or escape of any sewage, or other matter deleterious to public health, or destructive to fish, or throw or cast any dead animal, carrion, or offal, or other putrid or offensive matter into the waters of the Wallkill Creek, in the counties of Ulster and Orange. Any person violating any provision of this section shall forfeit to the county where the violation occurred the sum of $50 for every such violation.

75. *Discharge of sewage into the Susquehanna near Binghampton prohibited.*—No person or corporation shall cause to fall, flow, or discharge into the Susquehanna River or any of its tributaries, between the Rock Bottom Dam in such river at the city of Binghamton, and a point 1 mile east of the bridge that crosses such river at Conklin, any sewage matter, or other foul, noxious, or deleterious, solid or liquid matter, or any matter that may be declared such by the board of health of any municipality adjacent to such river within such limit. The board of health of any such municipality shall examine into any alleged offense against this section and cause the same to be abated, if found to exist. Every person violating any provision of this section shall forfeit to the municipality having a local board of health where the violation occurs the sum of $25 for the first day when the violation takes place, and the sum of $10 for every subsequent day that such violation is repeated or continued.

76 (as amended by Laws of 1911, chap. 553). *Prohibiting of pollution; exceptions.*—No person, corporation, or municipality shall place or cause to be placed, or discharge or cause to be discharged into any of the waters of this State, in quantities injurious to the public health, any sewage, garbage, offal, or any decomposable or putrescible matter of any kind or the effluent from any sewage-disposal plant, or any substance, chemical or otherwise, or any refuse or waste matter, either solid or liquid; from any sewer or drainage system, or from any shop, factory, mill, or industrial establishment; unless express permission to do so shall have been first given in writing by the State commissioner of health as provided in this article, except as hereinafter provided. But this section shall not prevent the discharge of sewage from any public sewer system owned and maintained by a municipality until an order prohibiting same shall be made as hereinafter provided, or the discharge of refuse or waste matter from any shop, factory, mill, or industrial establishment, if such sewer system was in operation and was discharging sewage, or such shop, factory, mill, or

industrial establishment was in operation and discharging refuse or waste matter into any of the waters of this State on or prior to May 7, 1908, and such municipality or the proprietor of such shop, factory, mill, or industrial establishment secured exemption from this section by filing a report with the State commissioner of health in accordance with law, nor to any extension or modification of such shop, factory, mill, or industrial establishment, or reconstruction thereof, provided the refuse or waste matter discharged therefrom is not materially changed or increased; but this exception shall not permit any increase in the discharge of such sewage, or in the discharge of refuse or waste matter from any shop, factory, mill, or industrial establishment, nor shall it permit the discharge of sewage from a sewer system which shall be extended, modified, or reconstructed subsequent to said date.

76a (added by laws of 1911, chap. 553). *State commissioner of health may order discontinuance of pollution.*—Whenever the State commissioner of health shall determine upon investigation that sewage from any city, village, town, building, steamboat or other vessel, or property, or any garbage, offal, or any decomposable or putrescible matter of any kind is being discharged into any of the waters of the State, which shall include all streams and springs and all bodies of surface and ground water, whether natural or artificial, within or upon the boundaries of the State, and when, in the opinion of the State commissioner of health, such discharge is polluting such waters in a manner injurious to or so as to create a menace to health, or so as to create a public nuisance, he may order the municipality, corporation, or person so discharging sewage, refuse, or other matter to show cause before him why such discharge should not be discontinued. A notice shall be served on the municipality, corporation, or person so discharging sewage, refuse, or other matter directing such municipality, corporation, or person to show cause before the said State commissioner of health on a date specified in such notice why an order should not be made directing the discontinuance of such discharge. Such notice shall specify the time when and place where a public hearing will be held by the State commissioner of health and notice of such hearing shall be published at least twice in a newspaper of the city, village, town, or county where such discharge occurs and shall be served personally or by mail at least 15 days before said hearing and in the case of a municipality or a corporation such service shall be upon an officer thereof. The State commissioner of health shall take evidence in regard to said matter and he may issue an order to the municipality, corporation, or person responsible for such discharge, directing that within a specified period of time thereafter such discharge be discontinued and such proper method of treatment or disposal of such sewage, refuse, or waste matter be adopted as will permanently obviate such pollution of said waters by the municipality, corporation, or person responsible therefor, and as such shall be approved by said commissioner. Such order shall not be valid until approved by the governor and attorney general, and when so approved it shall be the duty of the attorney general to enforce such order. Such means or method for the treatment or disposal of sewage, refuse, or other matter must be executed, completed, and put in operation within the time fixed in the order. The State commissioner of health shall have authority to require from the officials and persons responsible for the execution of such orders satisfactory evidence at specified times of proper progress in the execution of such orders, and may stipulate and require that certain definite progress shall be made at certain definite times prior to the final date fixed in the order. For the purpose of this article sewage shall be defined as any substance, solid or liquid, that contains any of the waste products or excrementitious or other wastes or wash-

ings from the bodies of human beings or animals. But this section shall not apply to refuse or waste matter from any shop, factory, mill, or industrial establishment not containing sewage as hereinbefore defined.

77 (amended by Laws of 1911, chap. 553). *Construction of sewerage systems.*—Upon application duly made to the State commissioner of health by the public authorities having by law the charge of the sewer system of any municipality, the State commissioner of health shall have power to consider the case of a sewer system otherwise prohibited by section 76 from discharging sewage into any of the waters of the State, and whenever in his opinion the general interests of the public health would not be endangered thereby he may issue a permit for the discharge of sewage from any such sewer system into any of the waters of the State, and may stipulate in the permit, modifications, regulations, and conditions on which such discharge may be permitted. Such application must be made in a form required by the State commissioner of health and he may require such plans and information to be furnished him as he deems advisable. The plans for the construction of any sewer system or sewage disposal plant or for the extension, reconstruction, or modification of sewers, sewer systems, or sewage disposal plants shall be so submitted with application for their approval, and a permit as herein provided. Such permit before being operative shall be recorded in the county clerk's office of the county wherein the outlet of the said sewer system is located, and a copy of the permit shall be transmitted by the State commissioner of health to the board of health of the municipality wherein the outlet of said sewer system is located.

78. *Permission to discharge refuse or waste matter from industrial establishments.*—Upon application duly made to the State commissioner of health by the proprietor, lessee, or tenant of any shop, factory, mill, or industrial establishment from which the discharge of refuse or waste matter into any of the waters of the State is otherwise prohibited by section 76, the State commissioner of health shall have power to consider the case of the said shop, factory, mill, or industrial establishment, and whenever the public health and purity of the waters shall warrant it he shall issue a permit for the discharge of refuse or waste matter from such shop, factory, mill, or industrial establishment into any of the waters of the State, and may stipulate in the permit such modifications, regulations, and conditions as the public health may require. Such permit before being operative shall be recorded in the county clerk's office of the county where such shop, factory, mill, or industrial establishment is located and a copy of such permit shall be transmitted by the State commissioner of health to the board of health of the municipality wherein the outlet discharging refuse or waste matter from such shop, factory, mill, or industrial establishment shall be located.

79. *Plans for refuse discharge pipes must be submitted.*—Before any conduit or discharge pipe, or other means of discharging or casting any refuse or waste matter from any shop, factory, mill, or industrial establishment not constructed or in process of construction on May 7, 1903, shall be put in or constructed for the purpose of discharging any refuse or waste matter therefrom into any waters in this State, the plan or plans therefor, together with a statement of the purpose for which the same is to be used, shall be submitted to the commissioner. If the same is not detrimental to the public health he shall issue a permit therefor to the applicant. No such conduit, discharge pipe or other means of discharging or casting any refuse or waste matter from any such shop, factory, mill, or establishment into any of the waters of this State shall be put in or constructed before such permit is granted, and if put in or constructed, the person putting in or constructing or maintaining the same shall forfeit to

the people of the State $5 a day for each day the same is used or maintained for such purpose, to be collected in an action brought by the commissioner. He may also maintain an action in the name of the people to restrain a violation of this section.

80. *Revocation of permit.*—Every such permit for the discharge of sewage from a sewer system or for the discharge of refuse or waste matter from a shop, factory, mill, or industrial establishment shall, when necessary to conserve the public health, be revocable or subject to modification or change by the State commissioner of health on due notice after an investigation and hearing and an opportunity for all interested therein to be heard thereon being served on the public authorities of the municipality owning and maintaining the sewage system, or on the proprietor, lessee or tenant of the shop, factory, mill, or industrial establishment. The length of the time after receipt of the notice within which the discharge of sewage or of refuse or waste matter shall be discontinued may be stated in the permit but in no case shall it exceed two years in the case of a sewer system, nor one year in the case of a shop, factory, mill, or industrial establishment, and if the length of time is not specified in the permit, it shall be one year in the case of a sewer system and six months in the case of a shop, factory, mill, or industrial establishment. On the expiration of the period of time prescribed after the service of a notice of revocation, modification, or change from the State commissioner of health the right to discharge sewage or refuse or waste matter into any of the waters of the State shall cease and terminate and the prohibition of this act against such discharge shall be in full force as though no permit had been granted, but a new permit may thereafter again be granted as hereinbefore provided.

81. *Reports of municipal authorities to local boards of health.*—The report of the public authorities having by law charge of the sewer system of every municipality in the State, from which sewer system sewage was being discharged into any of the waters of the State on May 7, 1903, transmitted by the board of health of the municipality within which any sewer outlet of the said sewer system is located to the State commissioner of health and filed by him in his office shall constitute the evidence of exemption from the prohibition of section 76 of this article. No sewer system shall be exempt from the prohibition of said section against the discharge of sewage into the waters of the State for which a satisfactory report shall not have been filed in the office of the State commissioner of health in accordance with laws of 1903, chapter 468.

82. *Reports of proprietors of industrial establishments.*—The report of the proprietor of every shop, factory, mill, and industrial establishment in the State, from which refuse or waste matter was being discharged into any of the waters of the State on May 7, 1903, filed in the office of the State commissioner of health, shall constitute the evidence of exemption of the shop, factory, mill, or industrial establishment from the prohibition of section 76 of this article. No shop, factory, mill, or industrial establishment shall be exempt from the prohibition of said section against the discharge of refuse or waste matter into the waters of the State, for which a report shall not have been made in accordance with laws of 1903, chapter 468.

83. *Record of permits; inspection of local boards of health.*—Each board of health shall preserve in its office and in a form to be prescribed by the State commissioner of health a permanent record of each permit issued by the State commissioner of health granting the right to discharge sewage or refuse or waste matter into any of the waters of the State within that municipality and of each revocation of a permit; and also a permanent record of each report

received by the board of health concerning each sewer system and each shop, factory, mill, or industrial establishment which on May 7, 1903, was discharging sewage or refuse or waste matter into any of the waters of the State within that municipality. Each local board of health shall make and maintain such inspection as will, at all times, enable it to determine whether section 76 of this article is being complied with in respect to the discharge of sewage, refuse, or waste matter or other materials prohibited by said section into any of the waters of the State within that municipality. For the purpose of such inspection every member of such board of health, or its health officers, or any person duly authorized by it, shall have the right to make all necessary examinations of any premises, building, shop, factory, mill, industrial establishment, process, or sewer system.

84 (amended by Laws of 1911, chap. 553). *Local board to ascertain violations, etc.*—The local board of health of each municipality shall promptly ascertain every violation of, or noncompliance with, any of the provisions of section 76 of this article or of the permits for the discharge of sewage or refuse or waste material into any of the waters of the State herein provided, which may occur within that municipality, or the State commissioner of health may ascertain such violations or noncompliance. The local board of health shall, on the discovery of every violation of or noncompliance with any of the provisions of said section or of any permit duly issued, report the same in writing to the said commissioner of health. Upon such report from a local board of health or upon ascertaining such violation or noncompliance, the State commissioner shall at once give a hearing to and take the proof of persons charged with such violation or noncompliance and investigate the matter, and if he finds a violation or noncompliance to exist he may bring an action in the name of the people of the State in a court of record against the person or corporation responsible for the violation or noncompliance, for the recovery of the penalties incurred, and for an injunction against the continuation of the violation or noncompliance.

85. *Penalties.*—The penalty for the discharge of sewage from any public sewer system into any of the waters of the State without a duly issued permit for which a permit is required by this article shall be $500, and a further penalty of $50 per day for each day the offense is maintained. The penalty for the discharge of sewage from any public sewer system into any of the waters of the State without filing a report for which a report is required to be filed with the board of health of the municipality shall be $50. The penalty for the discharge of refuse or waste matter from any shop, factory, mill, or industrial establishment for which a permit is required by this article, without such permit shall be $100 and $10 per day for each day the offense is maintained. The penalty for the discharge of refuse or waste matter from any shop, mill, factory, or industrial establishment, without filing a report where a report is required by this article to be filed shall be $25 and $5 per day for each day the offense is maintained. The penalty for discharging into any of the waters of the State any other matter prohibited by section 76 of this article, besides that specified above, shall be $25 and $5 per day for each day the offense is maintained.

86. *Constructions and limitations made by sections 76 to 85, inclusive.*—Nothing in sections 76 to 85, inclusive, shall be construed to diminish or otherwise to modify the common-law rights of riparian owners in the quality of waters of streams covered by such rights, nor in the case of actions brought against the pollution of waters to limit their remedy to indemnities.

87. *Actions by municipalities to prevent discharge of sewage into waters.*—Any incorporated city or village in the State of New York, which has made

such provision for the disposal of its sewage as not to pollute or contaminate therewith any river, stream, lake, or other body of water, may have and maintain an action in the supreme court to prevent the discharge of any sewage or substance deleterious to health, or which shall injure the potable qualities of the water in any river, stream, lake, or other body of water, from which such incorporated city or village shall take or receive its water supply, provided that such river, stream, lake, or other body of water is wholly or in part within the boundaries of the county in which such plaintiff is located. Whenever such action shall be brought under the provisions of this section, it shall be the duty of the supreme court upon proof of the existence of facts justifying the bringing and maintenance of such action under the provisions of this section to render a judgment in which shall be incorporated a mandatory injunction requiring the person, body, board, corporation, municipality, village, county, or town, being a defendant to said action which directly or indirectly, or by its servants, agents, or officers shall discharge or dispose of its sewage, or any other substance deleterious to health or which shall injure the potable qualities of the water in such wise as that the same shall enter into any river, stream, lake, or other body of water from which such plaintiff shall take or receive its water supply, within such reasonable time as may be prescribed by the court, to take such action as shall prevent such discharge or the disposal of such sewage or other substance into such waters, or the pollution thereof, with such further directions in the premises as may be proper and desirable to effect such purpose, provided that such river, stream, lake, or other body of water is wholly, or in part, within the boundaries of the county in which such plaintiff is located. But no such action shall be brought as provided for in this section until the State department of health has examined and determined whether the sewage does pollute or contaminate the river, stream, lake, or other body of water into which said sewage is discharged. The expense of such examination by said department shall be a charge upon and paid by the municipality in whose interest and on whose behalf such examination is made. In case the State department of health shall find upon examination that the discharge of said sewage does pollute or contaminate said waters, or any of them, in such manner as to be of menace or danger to the health of those using said waters, the plans for the removal or disposal of the sewage ordered to be prepared by the court, as provided in this section, shall be submitted to the State department of health for its approval.

312. *Bathing near sewers prohibited, etc.*—It shall be unlawful for any person to maintain, either as owner or lessee, any bathing establishment of any kind in this State for the accommodation of persons, for pay or any consideration, at a point less than 500 feet from any sewer connection emptying therein, or thereat, so as to pollute in any way the waters used by those using or hiring bathing houses at such bathing establishments * * *.

[SECOND CLASS CITIES LAW; CONSOLIDATED LAWS, 1909, CHAP. 55.]

94. *Commissioner of public works to prevent pollution of water supply.*—* * * It shall be the duty of the commissioner of public works to see that the city has an abundant supply of pure and wholesome water for public and private use; to devise plans and sources of water supply; to plan and supervise the construction, maintenance, and extension of the water system and the distribution of water through the city; to protect it from contamination * * *.

150. *Health officer to approve sewer plans.*—All plans for sewers and drains shall be submitted to the health officer for his approval before contracts are let for the construction of the same, and, in case he shall disapprove the same,

such sewer and drains shall not be constructed unless, on appeal to the commissioner, he shall approve the same. The health officer has power, subject to the right of appeal herein provided, to stop the construction or use of drains and sewers which are not properly constructed or properly used, or which are not in accordance with plans previously approved and adopted.

[VILLAGE LAW; CONSOLIDATED LAWS, 1909, CHAP. 64.]

260. *Village sewer commissioners.*—The board of sewer commissioners of a village may establish, extend, and maintain a sewer system therein. Before taking any proceedings for the construction of any sewer the board, at the expense of the village, shall, unless such map and plan have already been officially approved by the State commissioner of health and copies filed in the State department of health and in the office of the village clerk, cause a map and plan of a permanent sewer system for such village to be made, with specifications of dimensions, connections and outlets, or [sic] sewage-disposal works. * * * Such map and plan shall be submitted to the State commissioner of health for his approval, and if approved shall be filed in his office. A copy thereof shall also be filed in the office of the village clerk. * * * No work of any kind shall be done on or for the construction, extension, reconstruction, removal, or modification of any system of sewers, or of any sewer thereof, until a map and plan covering the entire system shall first have been duly approved and filed as above provided * * *.

[LAWS, 1917, CHAP. 600.]

SECTION 1. *Protecting New York City water supply in times of emergency.*—If, in the opinion of the governor, an emergency exists requiring such action in the interest of public safety, by reason of riots, insurrections, or when a state of war exists or is imminent, or in case of epidemics or a prevalence of disease, he may file a certificate in writing, in the office of the secretary of State, prohibiting fishing, boating, or ice-taking on any lake, reservoir, or other lands or waters the title to which is vested in the city of New York or owned, possessed, or controlled by such city and constituting a source of water supply of such city, after a date specified in such certificate; and after such date no person shall fish, boat, or cut ice on any such lake, reservoir, or other lands or waters, notwithstanding the provisions of any general, special, or local law authorizing the same. Such prohibition shall continue until the governor shall in like manner certify that the emergency upon which such prohibition was based shall have ceased: *Provided, however*, That the power hereby granted shall cease on the 1st day of September, 1918.

SEC. 2. *Penalty.*—Any person violating any of the provisions of this act shall be guilty of a misdemeanor.

[LABOR CAMPS—SANITARY REGULATION. CHAP. 5, REG. PUBLIC HEALTH COUNCIL, OCT. 20, 1914.]

REGULATION 1. *Pollution of waters prohibited.*—All persons living in the open or in camps, tents, or other temporary shelters shall exercise every proper and reasonable precaution to dispose of their wastes, so that springs, lakes, reservoirs, streams, and other watercourses shall not be polluted.

REG. 9. *No building, tent, or car in any camp to be nearer than 50 feet of water's edge of public-water supply.*—In every camp or temporary quarters the nearest part of any building, tent, car, or shed shall be at least 50 feet in a horizontal direction from the water's edge of any stream, lake, or reservoir,

except in the case of the Hudson River below the city of Albany, the waters of which are used for a public-water supply.

REG. 10. *Suitable privy or other toilet facilities to be provided and used.*—For every camp there shall be provided convenient and suitable privy or other toilet facilities approved by the local health officer, which the occupants of the camp shall be required to use instead of polluting the ground.

REG. 11. *Construction of privies more than 200 feet from the water's edge.*—If such privy be more than 200 feet from the water's edge of any spring, stream, lake, or reservoir forming part of a public or private water supply, it shall consist of a pit at least 2 feet deep, with suitable shelter over the same. No such pit shall be filled with excreta to nearer than 1 foot from the surface of the ground, and the excreta in the pit shall always be covered with earth or ashes. If the camp is to be occupied for more than six days between May 1 and November 1, the shelter and pit shall be inclosed in fly netting.

REG. 12. *Construction and care of privies located between 50 and 200 feet from the water's edge.*—If such privy be between 50 and 200 feet from the waters of a spring, stream, lake, or reservoir forming part of a public or private-water supply, there shall be no pit, but the excreta shall be received in a water-tight tub or bucket and periodically, as often as may be found necessary, shall be taken away and disposed of. Such privy shall be properly screened against flies and kept in a clean and sanitary condition; the pails or buckets shall not be allowed to fill so that they overflow or spill in carrying, and the construction of the privy shall be such that the convenient removal and replacement of the tubs or buckets is facilitated.

REG. 13. *Disposal of wastes from privies.*—The pails or buckets used in privies located between 50 and 200 feet from the water's edge, as referred to in regulation 12, shall when not more than three-quarters filled be removed from the privy and carried at least 200 feet from the water's edge and the contents there either burned or buried in a trench at least 2 feet deep, so that when buried there shall be at least 1 foot of earth cover. The tubs or buckets immediately after being emptied shall be rinsed out with a suitable disinfectant as particularly prescribed for such purposes by the special rules and regulations of the State department of health, and the rinsing fluid shall also be emptied into the trench.

REG. 14. *Garbage to be disposed of in suitable manner.*—All garbage, kitchen wastes, and other rubbish in camps shall be deposited in suitable covered receptacles, which shall be emptied daily or oftener if necessary, and the contents burned, buried, or otherwise disposed of in such a way as not to be or become offensive or insanitary.

REG. 15. *Water rules to be observed.*—Whenever a camp is established on the banks of a spring, lake, reservoir, stream, or other watercourse which is a source of water supply protected by water rules formulated by the State commissioner of health, no bathing or washing by the occupants of said camp shall be allowed in said springs, lakes, reservoirs, streams, or other watercourses, and all said water rules shall be strictly observed. There shall be furnished by the local health officer and conspicuously posted in such camp a copy of said rules or parts thereof as may be considered necessary by the State commissioner of health.

REG. 16. *Location and drainage of stables regulated.*—No stable or other shelter for animals shall be maintained within 100 feet of any living quarters in a camp, nor within 150 feet of any kitchen or messroom therein. No drainage from such stable or shelter shall be permitted to empty directly into any spring, lake, reservoir, stream, or other watercourse forming part of a public or private water supply.

[SANITARY CODE—PENALTY FOR VIOLATION. REG. PUBLIC HEALTH COUNCIL, JAN. 22, 1916 (AMENDMENT).]

REG. 2. *Violations declared to be misdemeanors.*—Any violation of any provision of this code is hereby declared to be a misdemeanor and is punishable by a fine of not more than $50, or by imprisonment for not more than six months, or by both. This regulation shall take effect throughout the State of New York, except in the city of New York, on the 1st day of March, 1916.

NORTH CAROLINA.

[PELL'S REVISAL OF 1908; GREGORY'S SUPPLEMENT, 1913; GREGORY'S REVISAL BIENNIAL, 1915.[1]]

2444. *Fish offal not to be thrown in navigable waters.*—If any person shall throw, or cause to be thrown, into the channel of any of the navigable waters of the State any fish offal in any quantity that shall be likely to hinder or prevent the passage of fish along such channel, or if any person shall throw, or cause to be thrown, into the waters known as the Frying Pan, tributary to the Great Alligator River, in Tyrrell County, any fish offal in any quantities whatsoever, he shall be guilty of a misdemeanor. (Pell's Revisal of 1908.)

2484t. (19)[2] *Use of drugs for taking fish prohibited.*—It shall be unlawful to place in any of the waters of this State * * * any drug or poisoned bait for the purpose of taking, killing, or injuring fish. And anyone violating this section shall, upon conviction, be fined not less than $100 and imprisoned not less than 30 days.

(20) *Discharging poisonous substances in waters.*—It shall be unlawful to discharge or to cause or permit to be discharged into the waters of the State any deleterious or poisonous substance or substances inimical to the fishes inhabiting the said waters; and any person, persons, or corporation violating the provisions of this section shall be guilty of a misdemeanor and, upon conviction, be fined or imprisoned, in the discretion of the court: *Provided*, This section shall not apply to corporations chartered either by general law or special act before the ratification of this act. (Gregory's Revisal Biennial, 1915.)

3048.[3] *Cities and towns to make inspection.*—Every city or town having a public water supply shall, at its own expense, have made at least once in every three months by one of its own officials a sanitary inspection of the entire watershed of its water supply, and it shall be the duty of the official making such inspection to report to the mayor any violation of this chapter [chap. 76, Water supplies, of Pell's Revisal]. (Pell's Revisal.)

3053. *No cemetery allowed on watershed.*—No burying ground or cemetery shall be established on the watershed of any public water supply nearer than 500 yards of the source of supply. (Pell's Revisal of 1908.)

3059.[4] *Mayors to have concurrent jurisdiction.*—The mayor of each city or town having a public water supply shall have concurrent jurisdiction with any

[1] Volume from which law was copied is indicated at the end of each section.

[2] See sec. 3417.

[3] It is doubtful whether this section is in force, as it conflicts in a degree with the provisions of 4434a. The repealing clause of chap. 62, Public Laws of 1911, which created 4434a, reads as follows: "All laws and clauses of laws in conflict with this act are hereby repealed." The intention of the legislature may, in fact, have been to repeal all laws relating to the subjects covered by 4434a (21–34), which would make some of the sections here given null and void. Sections evidently reenacted or superseded are given only under 4434a, footnotes showing the sections affected. They are 3045–3047, 3049–3052, 3054–3058, 3058a–c, 3060–3062, 3858, and 3862.

[4] This section might be construed to include violations of sections of chap. 76 reenacted as subsections of 4434a, because there is no definite repeal of those sections in chap. 62, Public Laws of 1911. See footnote to sec. 3048 above.

justice of the peace to hear and determine all violations of this chapter [chap. 76, Water supplies, of Pell's Revisal, 3045–3062], provided such violation is within the jurisdiction of the justice of the peace. (Pell's Revisal of 1908.)

3298. *Placing bodies of animals dying of infectious diseases in streams.*—If any hog or other animal shall die with the hog cholera or other infectious disease, and the owner thereof shall fail to burn or to so bury the same as to secure it from the reach or contact with other hogs or other domestic animals of value, or if he shall throw or place such hog or other animal in any ditch, canal, branch, creek, river, or other watercourses passing beyond his own premises, he shall be guilty of a misdemeanor, and upon conviction shall be fined not more than $50 or imprisoned not more than 30 days. (Pell's Revisal of 1908.)

3382a. *Placing sawdust in certain streams prohibited.*—If any person shall throw sawdust into any stream he shall be guilty of a misdemeanor and fined not more than $50 or imprisoned not more than 30 days. This section shall apply to the following streams only:[1] * * *: *Provided*, This act shall not apply to streams wherein rainbow trout have been placed. (Gregory's Supplement, 1913.)

3417.[2] *Poisoning water supplies.*—If any person shall put any poisonous substance for the purpose of catching, killing, or driving off any fish in any of the waters of a creek or river, he shall be guilty of a misdemeanor. (Pell's Revisal of 1908.)

3456.[3] *Making wells, etc., unwholesome.*—If any person shall willfully put into the well, spring, or cistern of water of any other person any substance or thing whereby such well, spring, or cistern may be endamaged or the water thereof be made less wholesome or fit for use, he shall be guilty of a misdemeanor. (Pell's Revisal of 1908.)

3457.[4] *Willful corruption of sources of water supply.*—If any person shall willfully or maliciously defile, corrupt, or make impure any well, spring, or other source of water supply, or reservoir, or destroy or injure any pipe, conductor of water, or other property pertaining to an aqueduct, or shall aid and abet therein, he shall be guilty of a misdemeanor.

For any violation of this section or of the laws relating in any way to the public health it shall be the duty of the solicitors of the several judicial districts, upon complaint of the board of health, or of any of its officers, or of any individual injured or likely to be injured, to institute a criminal action against the person, firm, corporation, or municipality charged with such violation in their respective districts and prosecute the same. (Gregory's Supplement, 1913).

3458. *Water supply of public institutions.*—If any person shall in any way intentionally or maliciously damage or obstruct any water line of a public institution, or in any way contaminate or render the water impure or injurious, he shall be guilty of a misdemeanor and shall be fined or imprisoned, in the discretion of the court. (Pell's Revisal of 1908.)

3857.[5] *Depositing human excreta on watersheds.*—If any person shall collect and deposit human excreta on the watershed of any public water supply, he shall be guilty of a misdemeanor, and punished by fine and imprisonment, in the discretion of the court. (Pell's Revisal of 1908.)

3859. *Disobeying provisions of law for protection of water supply.*—If any person residing on or owning property on a watershed of any stream from

[1] It has appeared unnecessary to list the streams.
[2] See 2484t(19), which is a later law.
[3] See 4434a(29).
[4] Superseded, in part at least, by 4434a(29), which see.
[5] This might be regarded as being superseded by 4434a(29).

which public drinking water is obtained shall fail to comply with the provisions of the law for protection of such water supply, he shall be guilty of a misdemeanor, and punished by a fine of not less than $2 nor more than $25, or by imprisonment for not less than 10 nor more than 30 days. (Pell's Revisal of 1908.)

3860. *Failure to provide system for protection of watershed.*—If any person or municipality shall violate the provision of law for protecting watersheds by failing to provide the tub system for human excrement, as required by law, he shall be guilty of a misdemeanor and fined or imprisoned in the discretion of the court. (Pell's Revisal of 1908.)

3861. *Inspection.*—Where the waterworks are owned and operated by any city or town, failure on the part of the municipal officials having in charge the management of the waterworks to comply with the law requiring sanitary inspection of watersheds shall be a misdemeanor and punished by a fine of not less than $10 nor more than $25, or by imprisonment for not less than 10 nor more than 30 days: *Provided* the said official do not prove to the satisfaction of the court that in spite of reasonable effort and diligence on his part he was prevented, directly or indirectly, by his superiors from doing his duty in this respect, in which case said superior officer shall be deemed guilty of a misdemeanor and punished by a fine of not less than $50 nor more than $200, or by imprisonment for not less than one nor more than six months. (Pell's Revisal of 1908.)

4434a. (21)[1] *Precaution against contamination; regulations of board of health.*—In the interest of the public health, every person, company, or municipal corporation or agency thereof selling water to the public for drinking and household purposes shall take every reasonable precaution to protect from contamination and assure the healthfulness of such water, and any provisions in any charters heretofore granted to such persons, companies, or municipal corporations in conflict with the provisions of this section are hereby repealed. The State board of health shall have the general oversight and care of all inland waters, and shall from time to time, as it may deem advisable, cause examinations of said waters and their sources and surroundings to be made for the purpose of ascertaining whether the same are adapted for use as water supplies for drinking and other domestic purposes, or are in a condition likely to impair the interests of the public or of persons lawfully using the same, or to imperil the public health. For the purpose aforesaid, it may employ such expert assistants as may be necessary. The said board shall make such reasonable rules and regulations as in its judgment may be necessary to prevent contamination and to secure other purifications as may be required to safeguard the public health. Any individual, firm, corporation, or municipality, or the person or persons responsible for management of the water supply, failing to comply with said rules and regulations, shall be guilty of a misdemeanor, and upon conviction shall be fined or imprisoned, or both, at the discretion of the court.

The State board of health shall from time to time consult with and advise the boards of all State institutions, the authorities of cities and towns, corporations or firms already having or intending to introduce systems of water supply, drainage or sewerage, as to the most appropriate source of supply, the best practical method of assuring the purity thereof; or of disposing of their drainage or sewage, having regard to the present and prospective needs and interests of other cities, towns, corporations, or firms which may be affected thereby. All such boards of directors, authorities, corporations, and firms are hereby

[1] Reenacts unaltered secs. 3058, 5058a, supersedes secs. 3058b–e.

required to give notice to said board of their intentions in the premises and to submit for its advice outlines of their proposed plans or schemes in relation to water supplies and disposal of sewage, and no contract shall be entered into by any State institution or town for the introduction of a system of water supply or sewage disposal until said advice shall have been received, considered, and approved by the said board. For the purpose of carrying out the general provisions of this section, every municipal or private corporation, company, or individual supplying or authorized to supply water for drinking or other domestic purposes to the public shall file with the secretary of the State board of health, within 90 days after the receipt of notice from said secretary, certified plans and surveys, in duplicate, pertaining to the source from which the water is derived, the possible source of infections thereof, and the means in use for the purification thereof, in accordance with the directions to be furnished by the said secretary. Failure on the part of any individual, firm, corporation, or municipality to comply with this section shall be a misdemeanor, and upon conviction those responsible therefor shall be fined not less than $50 nor more than $100, at the discretion of the court.

(22.)[1] *Condemnation of lands.*—All municipalities operating water systems and sewer systems, and all water companies operating under charter from the State or license from municipalities, which may maintain public water supplies, may acquire by condemnation such lands and rights in lands and water as are necessary for the successful operation and protection of their plants, said proceedings to be the same as prescribed by law for acquiring right of way by railroad companies.

(23.)[2] *May enter upon lands to lay pipes, etc.*—For the purpose of providing water supplies, the directors or other lawful managers of any public institution of the State may enter upon the lands through which they desire to conduct their pipes for said purpose, and lay them underground, and they at all times shall have the right to enter upon said lands for the purpose of keeping the water line in repair and do all things to that end.

(24.)[3] *Compensation for land.*—If damages shall be claimed for the use of such lands, and the parties can not agree as to the amount of compensation to be paid, they may proceed in the manner now provided by law for railroad companies to procure right of way.

(25.)[4] *Inspections of watersheds.*—Any waterworks that derive their water from a surface supply shall have a quarterly sanitary inspection of the entire watershed, except in those cases where the supply is taken from large creeks or rivers that have a minimum daily flow of 10,000,000 gallons, in which case the inspection shall apply to the 15 miles of watershed above the waterworks intake. Such water companies shall cause to be made a sanitary inspection of any particular locality on said watershed at least once in every week, whenever in the opinion of the board of health of the city or town to which the water is supplied, or, when there is no such local board of health, in the opinion of the county superintendent of health or in the opinion of the State board of health, there is special reason to apprehend the infection of the water from that particular locality by the germs of typhoid fever or cholera. The inspection of the entire watershed as herein provided for shall include a particular examination of the premises of every inhabited house on the watershed, and, in passing from house to house, a general inspection for dead bodies

[1] Supersedes sec. 3060.
[2] Reenacts unaltered sec. 3061.
[3] Reenacts unaltered sec. 3062.
[4] Supersedes secs. 3045, 3046.

of animals or accumulation of filth. It is not intended that the term "entire watershed" shall include uninhabited fields and wooded tracts that are free from suspicion. The inspection shall be made by an employee of and at the expense of said water company in accordance with reasonable instructions as to methods, scope, and details, to be furnished by the secretary of the State board of health. The said sanitary inspector shall give in person to the head of each household on said watershed or, in his absence, to some member of said household, the necessary directions for the proper sanitary care of his premises. It shall further be the duty of said inspector to deliver to each family residing on the watershed such literature on pertinent sanitary subjects as may be supplied him by the municipal health officer or by the secretary of the State board of health. Full report in duplicate of all such inspections shall be made promptly to the secretary of the State board of health and their accuracy certified to by the affidavit of the inspector, or such officer or person as the said secretary may direct.

(26)[1] *Inspections of watersheds; penalty for failure.*—Failure on the part of those having in charge the management of public water supplies to comply with the law requiring sanitary inspections of watersheds shall be a misdemeanor and punished by a fine of not less than $25 nor more than $100, or by imprisonment for not less than 10 nor more than 30 days: *Provided*, The said official does not prove to the satisfaction of the court that, in spite of reasonable effort and diligence on his part, he was prevented, directly or indirectly, by his superiors from doing his duty in this respect; in which case the said superior officer shall be deemed guilty of a misdemeanor and punished by a fine of not less than $50 nor more than $200, or by imprisonment for not less than one nor more than six months.

(27.)[2] *Inspectors may enter upon premises.*—Each sanitary inspector herein provided for is authorized and empowered to enter upon any premises and into any building upon his respective watershed for the purpose of making the inspections required.

(28.)[3] *Residents on watersheds to obey instructions.*—Every person residing or owning property on the watershed of a lake, pond, or stream from which a drinking supply is obtained shall carry out such reasonable instructions as may be furnished him in the matter hereinbefore set forth directly by the municipal health officer or by the State board of health. Anyone refusing or neglecting to comply with the requirements of this section shall be guilty of a misdemeanor and fined not less than $10 nor more than $50, or imprisoned for not less than 10 nor more than 30 days.

(29.)[4] *Damage to water supply.*—If any person shall defile, corrupt, or make impure any well, spring, drain, branch, brook, creek, or other source of public water supply by collecting and depositing human excreta on the watershed, or depositing or allowing to remain the body of a dead animal on the watershed, or in any other manner, and if any person shall destroy or injure any pipe, conductor of water, or other property pertaining to an aqueduct, or shall aid and abet therein, he shall be guilty of a misdemeanor.

(30.)[5] *Sewage not discharged in.*—No person, firm, corporation, or municipality shall flow or discharge sewage above the intake into any drain, brook, creek, or river from which a public drinking-water supply is taken, unless the same

[1] Supersedes sec. 3047.
[2] Reenacts unaltered sec. 3050.
[3] Supersedes sec. 3049.
[4] Supersedes sec. 3862, and, in part at least, sec. 3457, given above. See also secs. 3456 and 3857.
[5] Supersedes sec. 3051.

shall have been passed through some well-known system of sewage purification approved by the State board of health; and the continued flow and discharge of such sewage may be enjoined upon application of any person.

(31)[1] *Discharging sewage into certain streams.*—If any person, firm, or corporation, or other officer of any municipality having a sewerage system in charge shall violate the provision of the law relating to discharging sewage into streams from which public water is taken, he shall be guilty of a misdemeanor.

(32)[2] *Towns, etc., not having sewerage systems.*—All schools, hamlets, villages, towns, or industrial settlements which are now located or may be hereafter located on the shed of any public water supply, not provided with a sewerage system, shall provide and maintain a reasonable system approved by the State board of health for collecting and disposing of all accumulations of human excrement within their respective jurisdiction or control. Anyone refusing or neglecting to comply with the requirements of this section shall be guilty of a misdemeanor and fined not less than $10 or more than $50, or imprisoned for not less than 10 nor more than 30 days.

(33)[3] *State laboratory of hygiene; anaylses of water, sputum, blood, etc., appropriation for; tax against water companies.*—For the better protection of the public and to prevent the spread of communicable diseases, there shall be established a State laboratory of hygiene, the same to be under the control and management of the State board of health, and it shall be the duty of the State board of health to have made in such laboratory monthly examinations of samples from all public water supplies of the State, of all waters sold in bottle or other package and of all spring waters that are maintained and treated as an adjunct to any hotel, park, or resort for the accommodation or entertainment of the public: *Provided*, That in the case of springs in connection with hotels, parks, or resorts intermittently operated, examinations of the water shall be made monthly during the period only that they are open for the accommodation and entertainment of the public; but if upon the examination of the water of any such spring it shall be found to be infected or contaminated with intestinal bacilli or other impurities dangerous to health, examinations shall be made weekly until its purity and safety are shown. The board shall also cause to be made examinations of well and spring waters when in the opinion of any county superintendent of health or any registered physician there is reason to suspect such waters of being contaminated and dangerous to health. The board shall likewise have made in this laboratory examinations of sputum in cases of suspected tuberculosis, or throat exudates in cases of suspected diphtheria, of blood in cases of suspected typhoid and malarial fever, of feces in cases of suspected hookworm disease, and such other examinations as the public health may require. For the support of the said laboratory the sum of $4,000 annually is hereby appropriated and an annual tax of $64, payable quarterly, by each and every water company, municipal, corporate, and private, selling water to the people: *Provided*, That the said annual tax for waters from springs or wells sold in bottles or otherwise shall be as follows: For springs or wells the gross annual sales from which for the previous calendar year are less than $2,000 and more than $1,500, $50; less than $1,500 and more than $1,000, $40; less than $1,000 and more than $500, $30; less than $500 and more than $250, $20; and less than $250, $15; and for any spring maintained and treated as an adjunct to any hotel, park, or resort for the accommodation and entertainment of the

[1] Reenacts unaltered sec. 3858.

[2] Supersedes sec. 3052.

[3] Supersedes secs. 3056, 3057; apparently repeals secs. 3054, 3055. See footnote to sec. 3048 above.

public, $15, and an additional tax for water sold in bottle or other package from said spring in accordance with the above schedule.

Every corporation, firm, or person selling water in the manner set forth in this proviso shall file with the treasurer of the State board of health, within 60 days after the passage of this act and annually thereafter in the month of January, an affidavit as to the gross amount received from sale of water for the previous calendar year, and upon this affidavit the tax for the current year shall be based. Failure to so file said affidavit within the time prescribed shall subject the said corporation, firm, or person so failing to file said affidavit to double the tax for the current year. Failure to transmit sample within five days after receipt of sterilized bottle or container from the laboratory of hygiene shall be a misdemeanor, and upon conviction shall subject the delinquent to a fine of $25. Transportation charges, by mail, shall be paid by the sender; by express, by the laboratory. When deemed advisable, the said laboratory of hygiene shall analyze samples purchased by it in the open market in lieu of those sent direct from the spring. The said tax shall be collected quarterly by the sheriff as other taxes and shall be paid by the said sheriff directly to the treasurer of the State board of health. The printing and stationery necessary for the laboratory shall be furnished upon requisition upon the State printer. Any person, firm, or corporation not a citizen of the State of North Carolina who shall sell or offer for sale any water in bottle or other package for consumption by the people of the State of North Carolina shall obtain a license from the treasurer of the State board of health and shall pay for said license the sum of $64 per annum, or less amount equal to the tax paid by springs of the same class within the State upon compliance with the condition applying to them, payable in advance: *Provided*, That satisfactory evidence of purity funished by the State laboratory of other States agreeing to reciprocate in this matter with this State shall be accepted in lieu of the said license tax. If water sold by any person, firm, corporation, or municipality shall be discovered by three successive analyses made by the State laboratory of hygiene to be dangerous to the public health, publication of that fact shall be made in the monthly bulletin of the State board of health. The result of said analyses shall be immediately forwarded by mail to the person, firm, corporation, or municipality selling the water so analyzed. When upon subsequent analyses the water shall be found no longer dangerous to health, a certificate thereof shall be furnished the person, firm, corporation, or municipality offering the said water for sale, and publication of the fact shall be made in the said monthly bulletin: *Provided*, That this act shall not apply to the therapeutic waters so medicated as to render them sterile, the question of their sterility to be decided by the director of the State laboratory of hygiene.

(34) *Duties of solicitor to prosecute infringements.*—For every violation of sections 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, and 37[1] it shall be the duty of the solicitors of the several judicial districts, upon the complaint of the board of health, or any of its officers, or of any individual injured or likely to be injured, to institute a criminal action against the person, firm, corporation, or municipality charged with such violation in their respective districts, and prosecute the same. (Gregory's Supplement, 1913.)

4460a. *Emptying bowel discharges from typhoid patient on watershed.*—Any householder in whose family there is to his knowledge a person sick of cholera

[1]An amendment in 1913 (chap. 181) omitted three subsections, making new numbering necessary, but did not alter the numbers here given. Originally the specified subsections were those now numbered 22 to 34, inclusive. There is no subsection 37, and 35 and 36 refer to appropriations.

or typhoid fever who shall permit the bowel discharges of such sick person to be emptied without first having disinfected them according to instructions to be obtained from the attending physician or the county superintendent of health shall be guilty of a misdemeanor, and upon conviction shall be fined not less than $2 nor more than $25, or imprisoned not less than 10 nor more than 30 days. In cases where such undisinfected discharges are emptied on the watershed of any stream or pond furnishing the source of water supply for any public institution, city, or town, the penalty shall be a fine of not less than $25 nor more than $50, or imprisonment for not more than 30 days. * * * (Gregory's Supplement, 1913.)

[PUBLIC LAWS, 1917, CHAP. 123.]

SECTION 1. *Disposition of waste from kaolin mines.*—In getting out and washing the products of kaolin mines, the persons engaged in such business shall have the right to allow the waste, water, and sediment to run off into the natural courses and streams.

NORTH DAKOTA.

[COMPILED LAWS, 1913.]

400. *Regulations of State board of health.*—The board [State board of health] shall have power and it shall be its duty:

8. To make and enforce all needful rules and regulations for the prevention and cure and to prevent the spread of any contagious, infectious, or malarial diseases among persons and domestic animals.

2994. *Prohibiting contamination of water for hotels.*—It shall be the duty of every person conducting or operating a hotel, public inn, or lodging house to see that the drinking water supplied by said hotel, public inn, or lodging house is pure and free from disease germ. The source of supply must be far enough removed from privy vaults or other means of contamination to prevent drainage from said vaults to the wells or other source of supply, and the water supply shall be subject to examination by the inspector [inspector of hotels] and when found unfit for drinking purposes its use must be discontinued forthwith.

3697. *Discharge of sewage into streams.*—* * * Any city may empty or discharge its sewerage [sic] into any river, but where a dam on such river is located within the corporate limits of any city the sewerage [sic] shall in such cases be discharged below such dam: *And provided further*, That in case there is no river accessible into which to discharge such system of sewerage the same may be discharged into a lake, coulee, or slough, and in any of the latter cases a septic tank system shall be employed for sewerage [sic] from closets, kitchen sinks, or anything carrying objectionable matter prior to discharging same into the lake, coulee, slough, or other outlet, but that any drainage from basements, cellars, or surface may be discharged direct into the lake, coulee, slough, or other outlet prior to emptying into the main sewer system, but that any drainage from basements, cellars, or surface may be admitted direct into the main sewer system without first passing through the septic tank system.

5341. *Prohibiting pollution of water by owner of land underneath.*—The owner of the land owns water standing thereon or flowing over or under its surface but not forming a definite stream. Water running in a definite stream formed by nature over or under the surface may be used by him as long as it remains there, but he may not prevent the natural flow of the stream or of the natural spring from which it commences its definite course, nor pursue nor pollute the same.

5341a. *"Watercourse" defined.*—A watercourse entitled to the protection of the law is constituted if there is a sufficient natural and accustomed flow of water to form and maintain a distinct and defined channel. It is not essential that the supply of water should be continuous or from a perennial living source. It is enough if the flow arises periodically from natural causes and reaches a plainly defined channel of a permanent character.

9205. *Misdemeanors except where different punishment is prescribed elsewhere.*—Except in cases where a different punishment is prescribed by this code or by some existing provisions of law, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding one year, or by a fine not exceeding $500, or by both such fine and imprisonment.

9706. *Poisoning springs, etc.*—* * * every person who willfully poisons any spring, well, or reservoir of water is punishable by imprisonment in the penitentiary not less than 1 and not exceeding 10 years, or in a county jail not exceeding one year, or by a fine not exceeding $500, or by both such fine and imprisonment.

9747. *Fouling waters with gas tar.*—Every person who throws or deposits any gas tar or refuse of any gas house or factory into any public waters, river, or stream, or into any sewer or stream emptying into any such public waters, river, or stream, is guilty of a misdemeanor.

9754. *Violation of health laws.*—Every person who willfully violates any provision of the health laws the punishment for violating which is not otherwise prescribed by those laws or by this code, and every person who willfully violates or refuses or omits to comply with any lawful order, direction, prohibition, or regulation prescribed by any board of health or health officer, or any regulation lawfully made or established by any public officer under authority of the health laws, is punishable by imprisonment in a county jail not exceeding one year, or by a fine not exceeding $2,000, or both.

10225. *Fouling public waters.*—Every person who deposits or places or causes to be deposited or placed any dead animal, offal, or other refuse matter offensive to the sight or smell or deleterious to health upon the banks or in the waters of any lake or stream, so far as the same is within the jurisdiction of this State, is guilty of a misdemeanor, and upon conviction thereof is punishable by a fine of not less than $20 and not exceeding $100.

10226. *Extent of last section.*—The provisions of the last section shall be construed to include privies and privy vaults and any stable, shed, pen, yard, or corral wherein is kept any horse, cattle, sheep, or swine, and located nearer than 60 feet from the top of the bank of such lake or stream, and also any slaughterhouse, grave, graveyard, or cemetery located nearer than 80 feet therefrom. But the provisions of said section shall not be construed to prevent any incorporated city within this State from running its sewers into any river: *Provided*, That where there is a dam across said river within the corporate limits of any such city, any such sewer shall connect with such river below such dam.

[CHAP. 161, LAWS OF 1915.]

SEC. 78. *Drugs for taking of fish forbidden.*—No person shall lay, set, or use any drug, poison, lime, medicated bait, fish berries, dynamite, or other deleterious substance whatever * * * in any of the public waters of this State with intent thereby or therewith to catch, take, kill, or destroy any fish * * *.

SEC. 79. *Depositing sawdust.*—Any person who deposits any sawdust or other refuse in any lakes or streams of water wherein the State or Government has deposited any fish, fish eggs or fry, or may deposit any such fry, or where any game fish naturally abound, shall be deemed guilty of a misdemeanor.

OHIO.

[GENERAL CODE, 1912; SUPPLEMENT, 1916.[1]]

479. Protection of waters of State reservoirs.—The following rules are hereby adopted for the guidance of the superintendent of public works and of the police patrolmen appointed by said superintendent in the discharge of their official duties:

Rule 92. No sewer, drain, or other connection with closets, cesspools, sinks, privies, or other places where offensive or insanitary matter accumulates shall be drained or discharged into any State reservoir, and no garbage, offal, or filth of any kind shall be thrown or discharged in any manner into any such reservoir or immediate tributary thereto, and this rule shall apply to all house boats and buildings erected over the waters of any State reservoir. (Supplement, 1916.)

485 (as amended by Laws 1917, p. 461). *Laws for protection of fish apply to lakes used for park and pleasure-resort purposes.*—All lakes, reservoirs, and State lands dedicated to the use of the public for park and pleasure-resort purposes with respect to the enforcement of all laws relating to the protection of birds, fish, and game shall be under the supervision and control of the secretary of agriculture. All laws for the protection of fish in inland rivers and streams of the State and all laws for the protection of birds, fish, and game shall apply to all such State reservoirs and lakes.

1237. *Regulations of State board of health.*—The State board of health shall have supervision of all matters relating to the preservation of the life and health of the people * * *. It may make special or standing orders or regulations for preventing the spread of contagious or infectious diseases, * * * and for such other sanitary matters as it deems best to control by a general rule. * * * (General Code, 1912.)

1240. *Water, sewerage, and garbage; approval of the board required in certain cases; penalty.*—No city, village, public institution, corporation, or person shall provide or install for public use a water supply or sewerage system, or purification works for a water supply or sewage of a municipal corporation or public institution, or make a change in the water supply, waterworks intake, water-purification works of a municipal corporation or public institution until the plans therefor have been submitted to and approved by the State board of health. No city, village, corporation, or person shall establish a garbage disposal or manufacturing plant having a liquid waste which may enter any stream within 20 miles above the intake of a public water supply until the location of such garbage or manufacturing plant, including plans for disposing of such liquid waste, is approved by the State board of health. Whoever violates any provision of this section shall be fined not less than $100 nor more than $500. (General Code, 1912.)

1247. *Prosecutions under regulations of State board of health.*—All prosecutions and proceedings by the State board of health for the violation of a provision of this chapter [chap. 19, State board of health, secs. 1232–1261 (15). General Code, 1912] which the board is required to enforce, or for the violation of any of the orders or regulations of the board shall be instituted by its secretary on the order of the president of the board. The laws prescribing the modes of procedure, courts, practice, penalties, or judgments applicable to local boards of health shall apply to the State board of health and the violation of its rules and orders. All fines or judgments collected by the board shall be paid into the State treasury to the credit of such board. (General Code, 1912.)

[1] Volume from which law is taken is indicated at end of each section.

1249 (as amended by Laws, 1917, p. 184). *Complaint; by whom made; duty of State board.*—Whenever the council or board of health of a city or village, the commissioners of a county, the trustees of a township, or 10 of the qualified electors of any city or village set forth in writing to the State board of health that a city, village, corporation, or person is permitting to be discharged sewage or waste matter into a stream, watercourse, lake, or pond, and is thereby[1] creating a public nuisance detrimental to health or comfort, or is polluting the source of any public water supply, or that such city or village, having installed and ready for operation a sewage system and sewage-treatment plant neglects or fails for any reason to construct, erect, and put into operation a public water supply and a waterworks distribution system in order to furnish water to the inhabitants of said city or village, and to provide sufficient water to flush said sewers and to dispose of the sewage of said city or village, the State board of health shall forthwith inquire into and investigate the conditions complained of.

1250 (as amended by Laws, 1917, p. 184). *Findings of board; hearing.*—If the State board of health finds that the source of public water supply of a city, village, or community is subject to contamination, or has been rendered impure from the discharge of sewage or other waste matter, or in any other manner, by a city, village, corporation, or person, that such sewage or other waste matter have so corrupted a stream, water course, lake, or pond, as[2] to give rise to foul and noxious odors, or to conditions detrimental to the health and comfort of those residing in the vicinity thereof, or that a public water supply and a waterworks distribution system should be erected, constructed, installed, and put into operation, the State board of health shall notify such city, village, corporation, or person causing such contamination or pollution of its findings and give an opportunity to be heard.

1251 (as amended by Laws, 1917, p. 184). *Order of board; approval of governor and attorney general.*—After such hearing, if the State board of health determines that such improvements or changes are necessary and should be made, it shall report its findings to the governor and attorney general, and, upon their approval, the board shall notify such city, village, corporation, or person to install works or means, satisfactory to the board, for purifying or otherwise disposing of such sewage or other wastes, or to change or enlarge existing works, or to erect, construct, install, and put into operation a waterworks distribution system and a public water supply in a manner satisfactory to the board. Such works or means must be completed and put into operation within the time fixed by the board, which time shall be subject only to the approval of the governor and attorney general. But no city or village discharging sewage into a river which separates the State of Ohio from another State shall be required to install sewage-purification works, so long as the unpurified sewage of cities or villages of another State is discharging into such river above such city or village of this State.

1252. *Complaint of impure water supply.*—Whenever the board of health or health officer of a city or village, or 10 per cent of the electors thereof, file with the State board of health a complaint in writing, setting forth that it is believed that the public water supply of such city or village is impure and dangerous to health, the State board of health shall forthwith inquire into and investigate the conditions complained of. (General Code, 1912.)

1253. *Notice and hearing.*—If the State board of health finds that the public water supply of a city or village is impure and dangerous to health, and

[1] Amended law reads " hereby."
[2] Amended law reads " so as."

that it is not practicable to sufficiently improve the character of such supply by removing the source or sources of pollution affecting it, or if the board finds that such water supply is being rendered impure by reason of improper construction or inadequate size of existing water purification works, it shall notify such city, village, corporation, or person owning or operating such water supply of its findings and give them an opportunity to be heard. (General Code, 1912.)

1254. *May require changes on approval of governor and attorney general.*—After such hearing, if the State board of health determines that improvements or changes are necessary and should be made, it shall report its findings to the governor and attorney general, and upon their approval the board shall notify such city, village, corporation, or person owning or operating such water supply to change the source of supply or to install and place in operation water purification works or device satisfactory to the board, or to change or enlarge existing water purification works in a manner satisfactory to the board within a time to be fixed by the board, which time shall be subject to the approval of the governor and attorney general. (General Code, 1912.)

1255. *Order for improvement of waterworks.*—When the State board of health finds, upon investigation, that any water or sewage purification works, on account of incompetent supervision or inefficient operation, is not producing an effluent as pure as might reasonably be obtained from such plant, and by reason of which any public water supply has become dangerous to health, or any stream or body of water has become offensively polluted, or has become a public nuisance, the board shall issue an order to the officer, board, or department of a city or village, or the corporation or person having charge of or owning such plant, to secure an effluent as pure as might be reasonably expected from such plant and satisfactory to the board. (General Code, 1912.)

1256. *Operation of plant.*—If such officer, board, or department of such city, village, corporation, or person fails, for a period of five days after receiving such order, to secure such effluent, the State board of health shall report the fact to the governor and attorney general, and upon their approval may order such officer, board, or department, or owner of such plant to appoint within 10 days, and pay the salary of, a competent person, to be approved by the State board of health to take charge of and operate such works so as to secure the results demanded by the board. (General Code, 1912.)

1257. *Appeal and reference.*—If an order of the State board of health, when approved by the governor and attorney general, and made in pursuance of the provisions of this chapter relating to public water supply, is not acceptable to any city, village, corporation, or owner affected thereby, such city, village, corporation, or owner shall have the right of appeal, as follows: The necessity and reasonableness of such order may be submitted to two reputable and experienced sanitary engineers, one to be chosen by such city, village, corporation, or owner, and the other by the board, who shall not be a regular employee. Such examiners shall act as referees. If the engineers so chosen are unable to agree, they shall choose a third engineer of like standing, and the vote of the majority shall be final. (General Code, 1912.)

1258. *Power of referees; expenses.*—Such referee engineers may affirm, modify, or reject the order of the State board of health submitted to them, and their decision, as reported in writing to the governor and attorney general, which shall be rendered within a reasonable time, shall be accepted by the State board of health, and shall be enforced by the board in the manner provided for in this chapter. The fees and expenses of the referee engineers shall be equally divided between the city, village, corporation, or owner requesting such reference and the State board of health. (General Code, 1912.)

1260. *Forfeiture for failure to obey orders.*—If a council, department, or officer of a municipality, or person or private corporation fails or refuses for a period of 30 days, after notice given him or them by the State board of health of its findings and the approval thereof by the governor and attorney general, to perform any act or acts required of him or them by this chapter relating to public water supply, the members of such council or department, or such officer or officers, person or private corporation shall be personally liable for such default, and shall forfeit and pay to the State board of health $500, to be deposited with the State treasurer to the credit of the board. The governor and attorney general, upon good cause shown, may, in their discretion, remit such penalty, or any part thereof. (General Code, 1912.)

1261. *How action may be brought.*—An action may be begun for the recovery of such penalty by the prosecuting attorney of a county in the name of the State in the court of common pleas of such county having jurisdiction of any such party or parties; or it may be begun by the attorney general in such county or in the county of Franklin, as provided by law. (General Code, 1912.)

1446 (as amended by Laws, 1917, p. 489). *Using poisonous substances to take fish prohibited.*—No person shall take, catch, or kill fish in any waters over which the State of Ohio has jurisdiction by means of quicklime, electricity, or any kind of explosive or poisonous substance, or place or use quicklime, electricity, explosive or poisonous substances in any such waters except for engineering purposes and upon the written permission of the secretary of agriculture..

1447. *Penalty.*—Whoever violates any provision of the preceding section shall be fined not less than $50 nor more than $250 or be imprisoned not less than 30 days nor more than 6 months, or both. (General Code, 1912.)

3616. *Powers of municipal corporations.*—All municipal corporations shall have the general powers mentioned in this chapter [Enumeration of powers of municipal corporations, secs. 3615–3676], and council may provide by ordinance or resolution for the exercise and enforcement of them. (General Code, 1912.)

3619. *To prevent pollution of water supplies.*—To provide for a supply of water by the construction of wells, pumps, cisterns, aqueducts, water pipes, reservoirs, and waterworks, for the protection thereof, and to prevent unnecessary waste of water and the pollution thereof. * * * (General Code, 1912.)

3970. *Jurisdiction to prevent pollution of water supplies without corporate limits.*— * * * the corporation so extending and establishing any part of its waterworks outside of its limits shall have the same power and jurisdiction to prevent or punish pollution of or injury to the water so conveyed or injury to the works or any portion thereof as it has within the limits of such corporation. (General Code, 1912.)

3971. *Waterworks in contiguous municipality.*—A municipality owning waterworks whose territory is contiguous to that of another municipality, with the assent of such other municipality may establish and maintain such portion of its waterworks as it deems advisable within the limits of such other municipality * * *. (General Code, 1912.)

3972. *Jurisdiction to prevent pollution of water supplies in such case.*— * * * A municipality so establishing a part of its waterworks within the limits of such other municipality shall have jurisdiction to prevent or punish the pollution of or injury to water so conveyed or of the stream or source from which it is obtained or any injury to any portion of the waterworks so located within the limits of such other municipality. (General Code, 1912.)

4414. *Penalty for violation of health laws, etc.*—Whoever violates any provision of this chapter [board of health, secs. 4404–4476] or any order or regulation of the board of health made in pursuance thereof, or obstructs or interferes with the execution of such order, or willfully or illegally omits to obey such order, shall be fined not to exceed $100 or imprisoned for not to exceed 90 days, or both; but no person shall be imprisoned under this section for the first offense, and the prosecution shall always be as and for a first offense unless the affidavit upon which the prosecution is instituted contains the allegation that the offense is a second or repeated offense. (General Code, 1912.)

4415. *Violation by a corporation.*—If such violation, obstruction, interference, or omission be by a corporation, it shall forfeit and pay to the proper municipality a sum not to exceed $300, to be collected in a civil action brought in the name of the municipality. Any officer of such corporation having authority over the matter and permitting such violation shall be subject to fine or imprisonment, or both, as heretofore provided. The judgment herein authorized being in the nature of a penalty, or exemplary damage, no proof of actual damages shall be required, but the court or jury, finding other facts to justify recovery, shall determine the amount by reference to all the facts, culpatory, exculpatory, or extenuating, adduced upon the trial. (General Code, 1912.)

4420. *Regulation of cesspools, privies, etc.*—The board of health shall abate and remove all nuisances within its jurisdiction. * * * Except in cities having a building department, or otherwise exercising the power to regulate the erection of buildings, the board of health may regulate the location, construction, and repair of water-closets, privies, cesspools, sinks, plumbing, and drains. In cities having such departments or exercising such power, the council by ordinance shall prescribe such rules and regulations as are approved by the board of health and shall provide for their enforcement. (General Code, 1912.)

4421. *Regulation of pens, stables, sewerage, etc.*—The board of health may also regulate the location, construction, and repair of yards, pens, and stables, and the use, emptying, and cleaning thereof, and of water-closets, privies, cesspools, sinks, plumbing, drains, or other places where offensive or dangerous substances or liquids are or may accumulate. * * * (General Code, 1912.)

4464. *Regulation of sale of ice for domestic use.*—No ice shall be cut to be sold or used for domestic purposes in a municipality from a pond, lake, creek, or river within the limits of such municipality unless a permit therefor is first obtained from the board of health thereof. No person shall sell or deliver ice in a municipality for domestic purposes unless a permit therefor is first obtained from the board of health thereof. Such board may refuse a permit or revoke a permit theretofore granted when, in its judgment, such ice would be detrimental to public health. (General Code, 1912.)

4465. *Prohibiting sale and bringing in of impure ice.*—The board of health may prohibit the sale or use of any ice for domestic purposes within the limits of the municipality when, in its judgment, it is unfit for use and the use thereof would be detrimental to public health. The board may prohibit, and, through its officers, stop, detain, and prevent the bringing of any such ice for the purpose of sale or use for domestic purposes into the limits of the municipality and in the same manner stop, detain, and prevent the sale of such ice for domestic purposes within the limits of the municipality when, in its judgment, the use thereof would be detrimental to public health. (General Code, 1912.)

4466. *Penalty.*—Whoever violates any provision of the preceding two sections or an order or regulation of the board of health made in pursuance thereof shall be fined not to exceed $100. (General Code, 1912.)

12405. *Poisoning water supplies.*—Whoever * * * willfully poisons a well, spring, cistern, or reservoir of water, shall be imprisoned in the penitentiary not less than 2 years nor more than 15 years. (General Code, 1912.)

12525. *Use of poison for purpose of catching fish in certain waters.*—Whoever trespasses upon lands or rights in lands of another lying in or bordering upon a natural or artificial pond or brook less than 10 miles in length into which have been introduced brook trout, speckled trout, brown trout, landlock salmon, California salmon, or other fish by artificial propagation or actual importation from other waters for the purpose of fishing for, catching, or killing fish, * * * or willfully places poison or other substance injurious to the health of such fish, in a pond or brook described in this section for the purpose of capturing or harming such fish therein * * * shall be fined not less than $10 nor more than $100, and for each subsequent offense shall be fined not less than $25 nor more than $200 or imprisoned not less than 30 days nor more than 6 months, or both. (General Code, 1912.)

12526. *Owner or agent must make complaint.*—Prosecutions for a violation of any provision of the next preceding section shall be instituted only upon the complaint of the person or his agent upon whose lands or rights in lands or waters the trespass has been committed. (General Code, 1912.)

12602. *Putting soap, alkali, etc., into wells, etc.*—Whoever maliciously puts soap, alkali, or other material which will tend to interfere with or render unusually dangerous the generating of steam into a steam boiler, tank, well, cistern, pipe, hose, or other receptacle where such soap, alkali, or other material is liable to be drawn or pumped into a steam boiler or generator with intent to injure or damage another person or to delay or retard the running of an engine, locomotive, or machine shall be imprisoned in the penitentiary not less than 1 year nor more than 10 years or fined not less than $100 nor more than $500. (General Code, 1912.)

12646. *Punishment for nuisance of polluting watercourses.*—Whoever * * * corrupts or renders unwholesome or impure a watercourse, stream, or water * * * shall be fined not more than $500. (General Code, 1912.)

12647. *Throwing refuse, oil, or filth into lakes, streams, or drains.*—Whoever intentionally throws, deposits, or permits to be thrown or deposited, coal dirt, coal slack, coal screenings, or coal refuse from coal mines, refuse or filth from a coal-oil refinery or gas works, or whey or filthy drainage from a cheese factory into a river, lake, pond, or stream, or a place from which it may wash therein, or causes or permits petroleum, crude oil, refined oil, or a compound, mixture, residium of oil or filth from an oil well, oil tank, oil vat, or place of deposit of crude or refined oil to run into or be poured, emptied, or thrown into river, ditch, drain or watercourse, or into a place from which it may run or wash therein, upon conviction in the county in which such coal mine, coal oil refinery, gas works, cheese factory, oil well, oil tank, oil vat, or place of deposit of crude or refined oil is situated, shall be fined not less than $50 nor more than 1,000. (General Code, 1912.)

12648. *Fine and costs are a lien.*—Such fine and costs shall be a lien on such oil well, oil tank, oil refinery, oil vat, or place of deposit, and the contents thereof until paid and such oil well, oil tank, oil refinery, oil vat, or place of deposit and the contents thereof may be sold for the payment of such fine and costs upon execution duly issued for that purpose. (General Code, 1912.)

12649. *Depositing dead animals, offal, etc., in water.*—Whoever puts the carcass of a dead animal or the offal from a slaughter house, butcher's establishment, packing house or fish house, or spoiled meat, spoiled fish, or other putrid substance or the contents of a privy vault upon or into a lake, river, bay, creek,

pond, canal * * * shall be fined not less than $10 nor more than $50, and in default of the payment of such fine and costs, shall be imprisoned not more than thirty days. (General Code, 1912.)

12650. *Contents of privies must be buried at distance of springs, etc.*—The next preceding section shall not prohibit the deposit of the contents of privy vaults and catch basins into trenches or pits not less than 3 feet deep excavated in a lot, field or meadow, the owner thereof consenting, outside of the limits of a municipal corporation and not less than 30 rods distant from a dwelling, well, or spring of water, lake, bay, pond, canal, run, creek, brook, or stream of water, public road, or highway, provided that such contents so deposited are forthwith covered with at least 12 inches of dry earth; nor prohibit the deposit of such contents in furrows, as specified for such trenches or pits * * *. (General Code, 1912.)

12651. *Contents of privies may be buried in city where board of health consents.*—The board of health of a municipal corporation may allow such contents to be deposited within corporate limits into such trenches, pits, or furrows. (General Code, 1912.)

12654. *Defiling spring or well.*—Whoever maliciously puts a dead animal, carcass, or part thereof, or other putrid, nauseous, or offensive substance into, or befouls a well, spring, brook, or branch of running water, or a reservoir of a waterworks, of which use is or may be made for domestic purposes, shall be fined not less than $5 nor more than $50, or imprisoned not more than 60 days, or both. (General Code, 1912.)

12657. *Corporations may be prosecuted for nuisance.*—Corporations may be prosecuted by indictment for violation of any provision of this subdivision ["Nuisances," secs. 12646–12662] of this chapter, and in every case of conviction under such provisions, the court shall adjudge that the nuisance described in the indictment be abated or removed within a time fixed, and, if it is of a recurring character, the defendant shall keep such nuisance abated. (General Code, 1912.)

12783. *Putting dead animals in canals.*—Whoever willfully places, or causes to be placed, a dead animal in a canal or slack-water pool belonging to the State shall be fined not less than $5 nor more than $20. Such offender may be prosecuted before any justice of the peace in any county where he may be found. (General Code, 1912.)

12784. *Jurisdiction of municipality to prevent water pollution.*—Whoever pollutes a running stream, the water of which is used for domestic purposes by a municipality, by putting therein a putrid or offensive substance, injurious to health, shall be fined not less than $5 nor more than $500. The director of public service or board of trustees of public affairs of a municipal corporation shall enforce the provisions of this section. The jurisdiction of a municipal corporation to prevent the pollution of its water supply and to provide penalty therefor, shall extend 20 miles beyond the corporation limits. (General Code, 1912.)

14134. *Putting refuse matter into canals prohibited.*—No hay, straw, manure, or other litter of any kind, shall be deposited in any part of either of the canals of this State, nor on either of the banks thereof. * * * (General Code, 1912.)

[LAWS, 1917, P. 522.]

SECTION 1. *Creating State department of health.*—There is hereby created a State department of health, which shall exercise all the powers and perform all the duties now conferred and imposed by law upon the State board of health. * * *

OKLAHOMA.

[REVISED LAWS, 1910; SUPPLEMENT, 1915.[1]]

473a. *City may close roads leading to acquired reservoir site.*—Any city or town, having acquired possession by purchase, condemnation, gift, or otherwise, of a reservoir site for a public water supply, is hereby authorized and empowered to close to travel any section line or public road leading into or through such reservoir site. (Supplement, 1915.)

473b. *Unlawful to damage fences inclosing reservoir site.*—It shall be unlawful for any person [to] cut, damage, or otherwise interfere with any fence inclosing any reservoir site, supplying any city or town with water; and any person violating the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not less than $50 or by imprisonment in the county jail for not less than 30 days, or by both such fine and imprisonment. (Supplement, 1915.)

478. *Protection of water supplies outside of city limits.*—Any city or town in this State, securing its water supply from a stream or reservoir located outside of its corporate limits, shall have the power, and it is hereby authorized, to designate, by ordinance, through its mayor and council or other lawmaking body, a district to be known as a water district; said water district to be designated by metes and bounds, and to embrace any lands directly or indirectly flowing or shedding water into any such stream or reservoir, in the discretion of said city or town; and said city or town, through its mayor and council or other lawmaking body, shall have the power, and is hereby authorized, to enforce any rules and regulations made by the State commissioner of health, the county superintendent of public health, or the city superintendent of public health for the protection of any such water supply. (Revised Laws, 1910.)

2091. *Punishment of misdemeanor.*—Except in cases where a different punishment is prescribed by this chapter ["Crimes and punishments," secs. 2082–2842], or by some existing provisions of law, every offense declared to be a misdemeanor is punishable by imprisonment in the county jail not exceeding one year or by a fine not exceeding $500, or both such fine and imprisonment. (Revised Laws, 1910.)

2521. *Carcasses of animals dying of infectious diseases not to be buried along watercourse.*— * * * It shall further be unlawful to bury any such carcass [of any domestic animal dying of any contagious or infectious disease] * * * in any land along any stream or ravine, where it is liable to become exposed through erosion of the soil, or where such land is any time subject to overflow. * * * (Revised Laws, 1910.)

2522. *Putting carcasses into wells, springs, etc., forbidden.*—It shall be unlawful for any person to leave or deposit, or cause to be deposited or left, the carcass of any animal, whether the same shall have died from disease or otherwise, in any well, spring, pond, or stream of water * * *. (Revised Laws, 1910.)

2523. *Violation of sections 2521 and 2522 a misdemeanor.*—Any person who violates the two preceding sections shall be guilty of a misdeameanor. (Revised Laws, 1910.)

2528. *Gas-factory wastes not to be deposited in public waters.*—Every person who throws or deposits any gas tar, or refuse of any gas house or factory, into any public waters, river, or stream, or into any sewer or stream emptying into

[1] Volume from which law was copied is indicated at the end of each section.

any such public waters, river, or stream, is guilty of a misdemeanor. (Revised Laws, 1910.)

3301. *Contaminating waters with lime, sawdust, drugs, etc., prohibited.*—No person shall deposit, place, throw, or permit to be deposited, placed or thrown, any lime, dynamite, poison, drug, sawdust, crude oil, or other deleterious substance in any of the streams, lakes, or ponds of this State, and any person violating the provisions of this section shall be punished by a fine of not less than $100 nor more than $500, or by imprisonment in the county jail not exceeding one year.[1] (Supplement, 1915.)

6787. *Rules and regulations to be made and enforced by State commissioner of health.*—The State commissioner of health shall have power to make and enforce any and all needful rules and regulations for the prevention and cure, and to prevent the spread of, any contagious, infectious, or malarial diseases among persons; * * * to remove or cause to be removed any dead, decaying, or putrid body, or any decayed, putrid, or other substance, that may endanger the health of persons or domestic animals * * *. (Revised Laws, 1910.)

6810. *Punishment for pollution of water supplies.*—Whoever willfully and maliciously deposits excrements, or foul or decaying matter, or in any manner corrupts any spring or reservoir or other source of water used for domestic purposes, or destroys or injures any pipe, conductor of water, or other property pertaining to an aqueduct, or aids or abets in such trespass, shall be punished by a fine of not less than $25 nor more than $100, or by imprisonment for not more than 30 days in jail, or by both such fine and imprisonment. (Revised Laws, 1910.)

6812. *Violation of regulations of State board of health, etc.*—Any person who shall knowingly violate any of the provisions of this article, or any lawful rule or regulation of the State board of health, or any rule or regulation of any inferior board of health, herein authorized to be made, shall be guilty of a misdemeanor, and on conviction, except as otherwise provided in this article [" Board of health," secs. 6786–6819 of chapter on " Public health and safety "], shall be punished by a fine of not less than $10 and not more than $50, or imprisonment in the county jail not more than 30 days, or both such fine and imprisonment. (Revised Laws, 1910.)

OREGON.

[LORD'S OREGON LAWS, 1910.]

2237. *Polluting water for domestic use with sewage unlawful.*—Any person who shall put any sewerage [sic], drainage, refuse, or polluting matter, as either by itself or in connection with other matter will corrupt or impair the quality of any well, spring, brook, creek, branch, or pond of water, which is used or may be used for domestic purposes, shall be deemed guilty of a misdemeanor.

2238. *Animal carcass, etc., not to be placed in water for domestic use.*—If any person shall put any dead animal carcass, or part thereof, excrement, putrid, nauseous, noisome, decaying, deleterious, or offensive substance into, or in any other manner not herein named befouls, pollutes, or impairs the quality of any spring, brook, creek, branch, well, or pond of water, which is or may be used for domestic purposes, * * * he shall be deemed guilty of a misdemeanor.

[1] This section appears under the game and fish laws.

2239. *Penalty for violating sections 2237 and 2238.*—Any person violating the provisions of this act [secs. 2237–2239] shall, upon conviction, be fined not less than $10 nor more than $50, or be imprisoned not less than 5 days nor more than 25 days, or by both fine and imprisonment. Justices of the peace shall have jurisdiction of offenses committed against the provisions of this act.

2240. *Polluting water used for domestic purposes or to which live stock have access unlawful.*—If any person or persons shall put any dead animal's carcass, or part thereof, or any excrement, putrid, nauseous, decaying, deleterious, or offensive substance, in any well, or into any spring, brook, or branch of running water, of which use is made for domestic purposes, or to which any cattle, horses, or other kind of stock have access, every person so offending shall, on conviction thereof, be fined in any sum not less than $3 nor more than $50.

2241. *Polluting water used for municipal supply in adjoining State.*—Any person who shall place or cause to be placed within any watershed from which any city or municipal corporation of any adjoining State obtains its water supply, any substance which either by itself or in connection with other matter will corrupt, pollute, or impair the quality of said water supply, or the owner of any dead animal who shall knowingly leave or cause to be left the carcass or any portion thereof within any such watershed in such condition as to in any way corrupt or pollute such water supply, shall be deemed guilty of a misdemeanor and upon conviction shall be punished by fine in any sum not exceeding $500.

2243. *Putting carcass in rivers, etc., unlawful.*—If any person or persons shall put any part of the carcass of any dead animal into any river, creek, pond, * * * or if the owner or owners thereof shall knowingly permit the same to remain in any of the aforesaid places to the injury of the health or to the annoyance of the citizens of this State, or any of them, every person so offending shall, on conviction thereof, be fined in a sum of not less than $2 nor more than $25, and every 24 hours during which said owner may permit the same to remain thereafter shall be deemed an additional offense against the provisions of this act.

2337. *Putting lime, poison, etc., into streams illegal without permit.*[1]—* * * (*b*) It shall be unlawful to place, or cast, or pass, or allow to be cast, or flow, or passed, any gas, lime, cocculus indicus, or extract therefrom, or any other substance poisonous to fish, in any lake, river, stream, pond, bay, or other waters within the boundaries of this State, without first obtaining an order permitting it to be done from the board of county commissioners of the county in which it is desired to use the poison, as hereinafter provided.

(*c*) It shall be unlawful to take, or kill, or injure any fish in any lake, river, stream, pond, bay, or other waters within the boundaries of this State * * * by means of lime, cocculus indicus, or extract therefrom, or other poison, without first obtaining an order of the county commissioners of the county permitting it to be done as hereinafter provided.

(*d*) Having in possession any trout, salmon, or other game fish under circumstances which make it reasonable to believe that they were taken and killed by means of lime or cocculus indicus or extract therefrom, or other poison, * * * shall justify the arrest of the person or persons so having the fish in their possession; and it shall then be incumbent upon such persons to prove and show that the fish were taken and killed by lawful means.

(*e*) Every person who aids or abets * * * in putting any lime, cocculus indicus, or extract therefrom, or other poison, in any lake, river, stream, pond, bay, or other waters within the boundaries of this State contrary to the provisions of this section, or who aids or abets in taking or killing any fish in

[1] See below, sec. 5269.

this State contrary to the provisions of this section, or who aids or abets in taking or securing any fish in this State which he knows or has reason to believe have been killed or injured contrary to the provisions of this section, shall be deemed guilty of violating this section, and upon conviction shall be punished as hereinafter provided.

(*g*) Whenever the owner of any lake or pond in this State desires to get rid of and kill the fish known as German carp in said lake or pond, he shall file a verified petition with the county commissioners of the county stating in what section, township, and range the lake or pond is situated, and with what waters it connects, and his reasons for wishing to kill the fish. He shall truly and particularly state what other kinds of fish are in the lake or pond. If the county commissioners are satisfied that there are no fish other than German carp, catfish, suckers, and such like worthless fish in the lake or pond, and that the same has no outlet whereby the poison can escape into other waters, the commissioners shall make an order permitting the person to put lime or other substance in the lake or pond for said purpose. If any person use lime or other poison in any water within the boundaries of this State, without first obtaining such order, or contrary to such order, he shall be deemed to have violated this section, and upon conviction shall be punished as hereinafter provided.

(*h*) Every person who desires to obtain permission to use * * * lime, or poison, under provisions of this section, shall serve upon the fish commissioner or State game and forestry warden of this State a certified copy of his petition not less than 10 days before the hearing of the petition. Such service may be made personally upon the fish commissioner or State game and forestry warden, or by registered mail, and the proof of service shall be filed with the commissioner. The fish commissioner or State game and forestry warden or any person interested may oppose the granting of the order, and the same may be reviewed.

(*i*) Any person or persons violating any of the provisions of this section shall be tried in the circuit court of the county wherein such offense shall have been committed, and upon conviction shall be both fined and imprisoned. If it is his first conviction for violating the provisions of said section, he shall be fined not less than $200, or by imprisonment in the county jail not less than 30 days nor more than one year, or by both such fine and imprisonment. If he is convicted of violating said section a second time, or oftener, he shall then be fined not less than $1,000 nor more than $3,000, and shall be imprisoned in the penitentiary not less than one year nor more than three years for each repeated offense.

3302. *Municipality of adjoining State may condemn lands to protect water supply.*—Any municipal corporation of any State adjoining the State of Oregon may acquire title to any land or water right within the State of Oregon, by purchase or condemnation, which lies within any watershed from which said municipal [corporation] obtains or desires to obtain its water supply.

4696. *County boards to enforce State board regulations.*—* * * It shall be the duty of the county boards of health to enforce all rules and regulations of the State board of health in their respective counties which may be issued from time to time for the preservation of the public health and for the prevention of endemic, epidemic, and contagious diseases[1] * * *.

4700. *Penalty for violation of preceding sections.*—Any person or persons, any board of health, or the officers of any corporation who shall violate any of the

[1] State board of health is authorized specifically only to make and enforce quarantine regulations. Sec. 4687 reads in part: "It [the State board of health] shall make, and is hereby empowered to enforce, such quarantine regulations as seem best for the preservation of the public health."

provisions of this act [secs. 4695–4700] shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not less than $10 nor to exceed $100.

5269. *Placing poison, etc., in waters containing salmon and other food fishes.*—It shall be unlawful for any person or persons to throw or cast or pass, or cause or permit to be thrown or cast or passed, in any waters of the State in which salmon fish of any kind, or other food fishes, are wont to be, any lime, drug, powder, medicated bait, gas, or cocculus indicus, or any other substance deleterious to fish, * * * for the purpose of catching, killing, or destroying any salmon or any food fish.[1]

5270. *Blood or offal of fish, etc., not to be deposited near dams in streams containing salmon and other food fishes.*—It shall be unlawful for any person to place in any stream of this State where salmon run or exist within the distance from any dam, fishway, or object in which the taking of salmon is prohibited by law, any blood or offal of salmon or fish, or any other substance or matter or contrivance that will frighten or drive salmon, or with intent to drive or frighten them from or out of that part of the waters of any stream in which it is unlawful to fish for or take the same.

5271. *Penalty for violating section 5270.*—Any person violating the provisions of this act [secs. 5270–5271] shall be punished by a fine of not less than $50 or not more than $1,000, or by imprisonment in the county jail not to exceed six months.

5346. *Depositing in water of matter injurious to shellfish forbidden.*—It shall be unlawful for any person to deposit into, or allow to escape into, or cause or permit to be deposited into, or escape into any of the public waters of this State, any substance of any kind whatever, which will or shall in any manner injuriously affect the life, growth, or flavor of oysters or other shellfish in or under said waters.

6525. *What use of water is a public one.*—The use of the water of the lakes and running streams of the State of Oregon for general rental, sale, or distribution, for purposes of irrigation and supplying water for household and domestic consumption and watering live stock upon dry lands of the State, is a public use, and the right to collect rates or compensation for such use of said water is a franchise. * * *

[GENERAL LAWS OF 1911, CHAP. 8.]

SECTION 1. *Discharge of sewage into North Umpqua River and tributaries prohibited.*—Any person or persons who shall put any sewage, drainage, refuse, or polluting matter, or any dead animal carcass, or part thereof, excrement, putrid, nauseous, decaying, deleterious, or offensive substance, which, either by itself or in connection with other matter, will corrupt or impair the quality of the water for domestic or municipal purposes, into the water of the North Umpqua River, or the tributaries thereof, above the Winchester Power Dam, in Douglas County, Oreg., said dam being located between the points, to wit, where said river is crossed by the Oregon & California Railroad and the county bridge spanning said stream 1,500 feet, more or less, east of said railroad crossing, or allow any such substance to escape into, or place any such substance in such position that it shall escape or be carried into said waters, or in any other manner not herein named, shall befoul, pollute, or impair the qualities of such waters for domestic or municipal purposes, shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished as hereinafter provided.

[1] See section 2337 above.

SEC. 2. *Penalty.*—Any company, corporation, or private individual violating any of the provisions of this act shall, upon conviction thereof, be fined in the sum of not less than $10 nor more than $100 or imprisoned in the county jail not less than 5 nor more than 50 days, or both such fine and imprisonment, in the discretion of the court.

SEC. 3. *Jurisdiction.*—Courts of the justice of the peace shall have concurrent jurisdiction with the circuit courts of this State in the trial of all proceedings under this act, and it shall be the duty of the county health officer of Douglas County, Oreg., to enforce the provisions of this act.

[GENERAL LAWS OF 1911, CHAP. 45.]

SECTION 1. *Discharge of sewage into Deschutes River or tributaries prohibited.*—It shall be unlawful for any person or persons, company, association, or corporation to put or deposit in the Deschutes River in the State of Oregon, of any tributary thereof, or artificial canal or ditch in which the waters of said Deschutes River runs, any sewage, refuse, waste, or polluting matter, or any dead animal carcass or part thereof, or any matter which either by itself, or in connection with any other substance, will corrupt or impair the quality of the water of said river for domestic or municipal purposes, or to place any such substance in such position that it shall escape or be carried into said waters by the action of the elements or otherwise.

SEC. 2. *Penalty.*—Any person or persons, company, association, or corporation violating the provisions of this act shall, upon conviction thereof, be punished by a fine of not less than $25 nor more than $500, or by imprisonment in the county jail not less than 10 days nor more than three months, or by both such fine and imprisonment.[1]

[GENERAL LAWS OF 1913, CHAP. 14.]

SEC. 19. *Leaving carcass within one-half mile of running water.*—Any person who shall knowingly leave the carcass of any domestic animal which he has owned or had in charge * * * within one-fourth mile of any running stream of water for longer than fifteen hours without burying or burning the same, shall be guilty of a misdemeanor, and upon conviction shall be fined not less than $50 nor more than $250.[2]

[GENERAL LAWS OF 1913, CHAP. 282.]

SEC. 42. (a) *Lumber waste, dyes, chemicals, decaying substances, etc., not to be deposited in streams.*—No person, or the proprietor, operator, agent, superintendent, or employee of any railroad company, saw mill, or other lumber or manufacturing concern, or any pulp mill, wood-saw, tannery, woolen mill, dye works, chemical works, slaughterhouse, or any manufacturing concern, or any steamboat, or any other water craft shall cast or suffer or permit any sawdust, planer shavings, wood pulp, or other lumber waste, or any element or chemical extracted therefrom, or any slashing of trees or brush, or any oil, coal tar, petroleum or extract therefrom, or any dye, or chemical to be thrown, cast or discharged in any manner, or to deposit the same where high water will take or carry same, into the waters of the State of Oregon.[3]

---

[1] Contains emergency clause, excepting it from the powers of the referendum, because of the polluted condition of the Deschutes River.

[2] Substantially the same as sec. 5660 of Lord's Oregon Laws, repealed by this act.

[3] Substantially like sec. 2338 of Lord's Oregon Laws, repealed by this act.

(b) *Dead animal carcass, etc., not to be put into waters of State.*—Any person who shall put any dead animal carcass, or part thereof, manure, putrid, decaying or deleterious substance in any of the waters of the State of Oregon, or who in any manner not herein named, pollutes or impairs the quality of any spring, brook, creek, branch, or pond of the State of Oregon inhabited by fish shall be guilty of a misdemeanor and punished as hereinafter provided.

SEC. 62. (b) *Penalty.*—Unless otherwise specifically provided, any person violating any of the provisions of this act shall be guilty of a misdemeanor and shall be punished by a fine of not less than $25 or more than $500 and costs of such suit or action, or by imprisonment in the county jail in the county wherein such unlawful act was committed for not less than 30 days or more than six months, or both such fine and imprisonment.

[GENERAL LAWS OF 1915, CHAP. 73.]

SEC. 1. *Approval of State board of health required for use of new water supplies.*—Any incorporated town or city in the State desiring to provide a new water supply for drinking or culinary purposes or any person or corporation who shall undertake to provide a new water supply for a town or city or for any number of persons exceeding 10 families or a total of 50 persons shall, before performing any work on the ground (other than making examination or surveys for the preparation of provision of such water supply), submit to the State board of health plans showing the source of the supply, and the transmission and distribution systems, with further information as to the amount proposed to be taken and transmitted, the drainage areas from which the waters are to be derived, the purity and wholesomeness of the supply, the kind and character of the works for gathering, storing and transmitting the water, and the number of persons to be supplied, together with any additional data which the board of health may require as in its judgment proper to enable it to pass intelligently upon the effect of such water supply upon the public health. No such work shall be undertaken or proceeded with until the board of health shall have approved such plans, either as originally offered or as modified pursuant to its requirements.

SEC. 2. *Approval of State board of health required for constructing sewage-disposal plants, etc.*—Any city or town in the State proposing a sewer system or any individual or corporation proposing to install a system of sewerage or disposal of waste products for the use of more than five families or 50 persons shall, before undertaking any work on the ground other than making surveys and preliminary plans, submit to the State board of health the full plans and specifications for the system, showing particularly the location of the outfall and the streams or other places of final disposal, and the method, if any, for the reduction, purification, or use of the sewage. No such plan shall be proceeded with or work done thereon until the plans and specifications either as originally proposed or modified are approved by the State board of health.

SEC. 3. *Penalty.*—Any violation of the provisions of this act shall be a misdemeanor and shall be punished by a fine of not more than $500 or by imprisonment of not more than six months in the county jail, and every person in any way responsible for the proceeding with the actual construction of such work until the approval of the State board of health shall have been given thereon shall be deemed guilty of a violation of this act. The State board of health may, by proceeding in the proper court, enjoin any construction of sewerage or sewage disposal to which it has not given its approval.

PENNSYLVANIA.

[PURDON'S SUPPLEMENT OF 1915; BOROUGHS.]

393.[1] *Borough's power of appropriation for purposes of waterworks.*—Any borough desiring to erect waterworks, or to improve its water supply, may appropriate springs, streams, rivers, or creeks, and lands, easements, and rights of way, within or without its limits * * * (p. 5411).

394.[2] *Cannot deprive owner of use of water for domestic purposes.*—No water appropriated under the provisions of the preceding section shall be used in such manner as to deprive the owner thereof of the free use and enjoyment of the same for domestic or farm purposes (p. 5411).

[PURDON'S DIGEST, 1903; BURIAL GROUNDS.]

6. *Prohibiting cemeteries on watersheds.*—It shall be unlawful to use for the burial of the dead, any land, the drainage from which passes into any stream furnishing the whole or any portion of the water supply of any city, except beyond the distance of 1 mile from such city: *Provided, however,* That the prohibitions of this act shall not be enforceable against any land now devoted to burial purposes in which there shall have heretofore been burials and sales of burial lots[3] (p. 559).

[SUPPLEMENT OF 1915; COUNTY COMMISSIONERS.]

66.[4] *Surveys and plans of sewage-disposal plants required.*—Whenever the commissioners of any county of this Commonwealth shall resolve to construct any such * * * sewerage-disposal [sic] plants in accordance with the provisions of this act,[4] they shall cause to be prepared surveys and plans of such * * * disposal plants * * * (p. 5805).

67.[5] *To whom plans are to be presented.*—The county commissioners shall, thereupon, present such surveys, plans, and estimates, or a copy thereof, together with their petition, to the court of quarter sessions of the county; * * * and, after publication, * * * the said court shall cause the said application to be laid before the grand jury, when in session * * * (p. 5806.)

68.[5] *Approval of State department of health required.*—After such plans and specifications have been prepared by said county commissioners, and before presentation thereof to the court or grand jury, as provided for in section 3 of this act [secs. 66 and 67 above], they shall be submitted to the State department of health; and approval by said State department of health of the same shall be first had in accordance with the act of assembly of April 22, 1905, entitled "An act to preserve the purity of the waters of the State, for the protection of the public health." (See "Gas and water companies," Supplement, secs. 14, 25, below, for text of law referred to.) (P. 5806.)

---

[1] Act of May 14, 1915, Public Laws, p. 312, sec. 8.

[2] Ibid., sec. 4.

[3] A note in the Supplement, p. 5498, referring to this section (which is sec. 1, Public Health Laws of 1895, p. 244), reads as follows: "This act is not a lawful exercise of police power and is therefore unconstitutional as local and special legislation. Philadelphia *v.* West Laurel Hill Cemetery Co., 21 Dist. 75."

[4] Act of June 5, 1915, Public Laws, p. 852, sec. 3.

[5] Ibid., sec. 4.

[DIGEST OF 1903; CRIMES.]

345. *Penalty for injury to waterworks.*—If any person shall, willfully and maliciously, injure any well sunk for the production of * * * water, or any tank intended or used for the storage of * * * or any line of pipe intended or used for the transportation of * * * water, or any machinery connected with such wells, tanks, or lines of pipe, he shall be guilty of a misdemeanor, and upon being thereof convicted, shall be sentenced to pay a fine, not exceeding $1,000, and undergo imprisonment not exceeding three years, or both, or either, at the discretion of the court (p. 983).

[DIGEST OF 1903; FISH.]

123. *Drainage from coal and other ores, and from tanneries, to be retained in tanks.*—All persons engaged in any of the manufacturing interests of this State, accustomed to the washing of iron and other ores, and of coal preparatory to its use for coking, or in the tanning of hides by process in which vitriol is used, shall prepare a tank or other suitable receptacle into which the culm or coal dirt, the offal, refuse, and the tan bark and the liquor, or the water therefrom, may be collected, so that the sediment therefrom, so far as is practicable, may be thereby prevented from passing into or upon any of the rivers, lakes, ponds, or streams of the Commonwealth, under a penalty of $50 for each offense, in addition to liability for all damage he or they have done to any individual owners or lessees on such waters (p. 1709).

[SUPPLEMENT OF 1915; FISH.]

82.[1] *Fishing with poisons forbidden.*—It shall be unlawful for any person to put or place in any waters within the Commonwealth any * * * poisonous substances whatsoever, or any drug, or any poison bait, for the purpose of catching, taking, killing, or injuring fish; or to allow any dyestuff, coal or gas tar, coal oil, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime, vitriol, or any of the compounds thereof, refuse from gas houses, oil tanks, pipes, or vessels, or any deleterious, destructive, or poisonous substances of any kind or character, to be turned into, or allowed to run, flow, wash, or be emptied into, any of the waters aforesaid, unless it is shown to the satisfaction of commissioner of fisheries, or the court, that every reasonable and practicable means have been used to prevent the pollution of waters in question by the escape of deleterious substances. In the case of the pollution of waters by substances known to be injurious to fishes or to fish food, it shall not be necessary to prove that such substances have actually caused the death of any particular fish * * *. Any person violating any of the provisions of this section, shall, on conviction as provided in section 27[2] of this act, be subject to a fine of $100[3] (p. 6187).

104.[4] *Use of poisons in Delaware River prohibited.*—It shall be unlawful for any person to put or place in the Delaware River below Trenton Falls any * * * poisonous substances whatsoever, or any drug, or any poison bait, for the purpose

[1] Act of May 1, 1909, Public Laws, pp. 353–374, sec. 16.

[2] Sec. 27 of this act (May 1, 1909, Public Laws, pp. 353–374) constitutes secs. 64 and 65 of the chapter on "Fish" in the Supplement of 1915. It does not appear necessary to quote the procedure given in those sections.

[3] This section replaces and supplements sec. 33 of the chapter on "Fish" in the Digest of 1903, repealed by this act.

[4] Act of May 1, 1909 (Public Laws, pp. 309–316, sec. 15), a different law from the one just quoted.

of catching, taking, killing, or injuring the fish; or to allow any dyestuff, coal or gas tar, coal oil, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime, vitriol, or any of the compounds thereof, refuse from gas houses, oil tanks or vessels, or any deleterious, destructive, or poisonous substances of any kind or character, to be turned into, or allowed to run, flow, wash, or be emptied into, any of the waters aforesaid, unless it is shown that every practicable means have been used to prevent the pollution of waters in question by the escape of deleterious substances. In case of pollution of waters by substances known to be injurious to fishes or to fish food, it shall not be necessary to prove that such substances have actually caused the death of any particular fish. Any person violating any of the provisions of this section shall, on conviction thereof, be subject to a fine of $200 (p. 6202).

129.[1] *Use of poisons in boundary lakes prohibited.*—It shall be unlawful for any person to put or place in any waters described in the first section of this act [lakes of more than 5,000 acres lying between Pennsylvania and any other State or foreign country and any water or bay adjacent to or connected with such lakes], over which this Commonwealth has jurisdiction, any * * * poisonous substances whatsoever, or any drug, or any poison bait, for the purpose of catching, taking, killing, or injuring fish; or to allow any dead fish, fish offal, contents of tannery vats, planing-mill shavings, dyestuff, coal or gas tar, coal oil, sawdust, tan bark, cocculus indicus (otherwise known as fish berries), lime, vitriol, or any of the compounds thereof, refuse from gas houses, oil tanks, pipes or vessels, or any deleterious, destructive, or poisonous substances of any kind or character, to be turned into, or allowed to run, flow, wash, or be emptied into, any of the waters aforesaid. In case of the pollution of waters by any substances known to be injurious to fishes or fish food, it shall not be necessary to prove that such substances have actually caused the death of any particular fish. Any person violating any of the provisions of this section shall, on conviction as provided in section 17[2] of this act, be subject to a fine of $100 (p. 6205).

[SUPPLEMENT OF 1915; GAS AND WATER COMPANIES.]

14.[3] *Definition of "waters."*—The term "waters of the State," wherever used in this act [secs. 14–25] shall include all streams and springs, and all bodies of surface and of ground water, whether natural or artificial, within the boundaries of the State (p. 6323).

15.[4] *Filing of plans and surveys.*—Every municipal corporation, private corporation, company, and individual supplying or authorized to supply water to the public, within the State, shall, within 60 days after the passage of this act, file with the Commissioner of Health a certified copy of the plans and surveys of the waterworks, with a description of the source from which the supply of water is derived; and no additional source of supply shall thereafter be used, without a written permit from the commissioner of health, as hereinafter provided (p. 6323).

16.[5] *Written permit from commissioner of health required for construction of waterworks, etc.*—No municipal corporation, private corporation, company, or

[1] Act of Apr. 18, 1913 (Public Laws, p. 100, sec. 5).

[2] Sec. 17 of this act (Apr. 18, 1913, Public Laws, p. 100) constitutes secs. 141 and 142 of the chapter on "Fish" in the Supplement of 1915. It does not appear necessary to quote the procedure given in those sections.

[3] Act of Apr. 22, 1905, Public Laws (pp. 260–263, sec. 1).

[4] Ibid. (sec. 2).

[5] Ibid. (sec. 3).

individual shall construct waterworks for the supply of water to the public within the State, or extend the same, without a written permit, to be obtained from the commissioner of health if, in his judgment, the proposed source of supply appears to be not prejudicial to the public health. The application for such permit must be accompanied by a certified copy of the plans and surveys for such waterworks, or extension thereof, with a description of the source from which it is proposed to derive the supply; and no additional source of supply shall subsequently be used for any such waterworks without a similar permit from the commissioner of health.

When application shall be made for a permit, * * * it shall be the duty of the commissioner to proceed to examine the application, without delay, and, as soon as possible, he shall make a decision, in writing; and, within 30 days after such decision, the corporation, company, or individual making such application may appeal to any court of common pleas of the county, and said court shall, without delay, hear the appeal, and shall make an order approving, setting aside, or modifying such decision, or fixing the terms upon which said permit shall be granted. The penalty for failure to file copies of plans, surveys, and descriptions of existing waterworks, within the time hereinbefore fixed, and for the construction or extension of waterworks, or the use of an additional source of supply, without a permit from the commissioner of health shall be $500, and further penalty of $50 per day for each day that the works are in operation contrary to the provisions of this act, recoverable by the Commonwealth, at the suit of the commissioner of health, as debts of like amount are recoverable by law (p. 6323).

17.[1] *Forbidding pollution of streams with sewage.*—No person, corporation, or municipality shall place or permit to be placed, or discharged, or permit to flow into any of the waters of the State any sewage except as hereinafter provided. But this act shall not apply to waters pumped or flowing from coal mines or tanneries, nor prevent the discharge of sewage from any public sewer system owned and maintained by a municipality, provided such sewer system was in operation and was discharging sewage into any of the waters of the State at the time of the passage of this act. But this exception shall not permit the discharge of sewage from a sewer system which shall be extended subsequent to the passage of this act (p. 6324).

18.[1] For the purpose of this act, sewage shall be defined as any substance that contains any of the waste products or excrementitious or other discharges from the bodies of human beings or animals.

19.[2] *Permits to discharge sewage, how obtained.*—Upon application duly made to the commissioner of health by the public authorities having by law the charge of the sewer system of any municipality, the governor of the State, the attorney general, and the commissioner of health, shall consider the case of such sewer system, otherwise prohibited by this act from discharging sewage into any of the waters of the State, and, whenever, it is their unanimous opinion that the general interests of the public health would be subserved thereby, the commissioner of health may issue a permit for the discharge of sewage from any such sewer system into any of the waters of the State, and may stipulate in the permit the conditions on which such discharge may be permitted. Such permit, before being operative, shall be recorded in the office of the recorder of deeds for the county wherein the outlet of the said sewer system is located. Every such permit for the discharge of sewage from a sewer system shall be revocable or subject to modification and

[1] Act of Apr. 22, 1905 (Public Laws, pp. 260–263, sec. 4).
[2] Ibid. (sec. 5).

change by the commissioner of health on due notice after an investigation and hearing and an opportunity for all interested therein to be heard thereon being served on the public authorities of the municipality owning, maintaining, or using the sewage system.

The length of time after receipt of the notice, within which the discharge of sewage shall be discontinued may be stated in the permit, but in no case shall it be less than one year, or exceed two years, and if the length of time is not specified in the permit it shall be one year. On the expiration of the period of time prescribed, after the service of a notice of revocation, modification, or change, from the commissioner of health, the right to discharge sewage into any of the waters of the State shall cease and terminate; and the prohibition of this act against such discharge shall be in full force, as though no permit had been granted, but a new permit may thereafter again be granted, as hereinbefore provided (p. 6324).

20.[1] *Report of municipalities to commissioner of health.*—It shall be the duty of the public authorities, having by law charge of the sewer system, of every municipality in the State, from which sewage was being discharged into any of the waters of the State at the time of the passage of this act, to file with the commissioner of health, within four months after the passage of this act, a report of such sewer system, which shall comprise such facts and information as the commissioner of health may require. No sewer system shall be exempt from the provisions of this act, against the discharge of sewage into the waters of the State, for which a satisfactory report shall not be filed with the commissioner of health, in accordance with this section (p. 6325).

21.[2] *Penalty for discharge of sewage without permit.*—The penalty for the discharge of sewage from any public sewer system into any of the waters of the State, without a duly issued permit, in any case in which a permit is required by this act, shall be $500, and a further penalty of $50 per day for each day the offense is maintained, recoverable by the Commonwealth, at the suit of the commissioner of health, as debts of like amount are recoverable by law. The penalty for the discharge of sewage from any public sewer system into any of the waters of the State without filing a report in any case in which a report is required to be filed shall be $50, recoverable by a like suit (p. 6325).

22.[3] *Commissioner may prevent discharge of sewage.*—All individuals, private corporations, and companies that, at the time of the passage of this act, are discharging sewage into any of the waters of the State may continue to discharge such sewage unless, in the opinion of the commissioner of health, the discharge of such sewage may become injurious to the public health. If at any time the commissioner of health considers that the discharge of such sewage into any of the waters of the State may become injurious to the public health, he may order the discharge of such sewage discontinued (p. 6325).

23.[4] *Discharge of sewage must be discontinued within 10 days after commissioner's order.*—Every individual, private corporation, or company shall discontinue the discharge of sewage into any of the waters of the State within 10 days after having been so ordered by the commissioner of health (p. 6325).

24.[5] *Penalties.*—Any individual, private corporation, or company that shall discharge sewage, or permit the same to flow, into the waters of the State, contrary to the provisions of this act, shall be deemed guilty of a misde-

[1] Act of Apr. 22, 1905, Public Laws (pp. 260–263, sec. 6).
[2] Ibid. (sec. 7).
[3] Ibid. (sec. 8).
[4] Ibid. (sec. 9).
[5] Act of Apr. 22, 1905, Public Laws (pp. 260–263, sec. 10).

meanor, and shall, upon conviction, be punished by a fine of $25 for each offense, and a further fine of $5 per day for each day the offense is maintained, or by imprisonment not exceeding one month, or both, at the discretion of the court (p. 6325).

25.[1] *Appeal from decision of health commissioner.*—Any order or decision, under this act, of the commissioner of health, or that of the governor, attorney general, and commissioner of health, shall be subject to an appeal to any court of common pleas of the county wherein the outlet of such sewer or sewer system, otherwise prohibited by this act, is situated; and said court shall have power to hear said appeal, and may affirm or set aside said order or decision, or modify the same, or otherwise fix the terms upon which permission shall be granted. But the order or decision appealed from shall not be superseded by the appeal, but shall stand until the order of the court, as above (p. 6326).

[DIGEST OF 1903; HEALTH.]

5. *Regulations of State department of health.*—* * * It [the State department of health[2]] shall codify and suggest amendments to the sanitary laws of the Commonwealth, and shall have power to enforce such regulations as will tend to limit the progress of epidemic diseases (p. 1828).

19. *Commissioner of health to examine water supply of cities of first class.*—The State board of health [commissioner of health] shall be and is hereby authorized to examine the water supplied to cities of the first class of this Commonwealth for domestic uses, for the purpose of ascertaining whether said water is free from contamination by human excrement (p. 1831).

20. *If water supply is found contaminated, commissioner of health to ascertain cause, and abate same.*—Should it be ascertained by said examination that the water supplied, as aforesaid, is so contaminated, the said board [commissioner] is hereby authorized and directed to make such investigation as will ascertain the cause thereof, and whether the water is so polluted, and to this end may, by its [his] duly accredited officers or agents, enter upon any property where the cause of said pollution is believed to exist, provided a warrant for said purpose shall first have been obtained from a magistrate or justice of the peace of the county wherein said property is situated, upon an affidavit of an officer or agent of the said board [commissioner] that there is information or belief of said pollution. And if it shall be found that said pollution is due to the fault or neglect of any person or corporation owning or occupying said property, to thereupon adopt such measures for the removal or abatement of said causes, so that the water supplied, as aforesaid, may be made free from contamination by said excrement (p. 1831).

21. *Method of abatement when contamination amounts to common nuisance.*—In order to carry out the provisions of the foregoing section, the said board [commissioner] is hereby authorized and directed to notify, or cause to be notified, every person or corporation upon whose property, or in connection with whose business said contamination exists or has its origin, which is found by said board [commissioner] to pollute the water supplied, as aforesaid, and is thereby a nuisance, to remove or abate the same within a reasonable time, to be stated in said notice. Should the party notified fail to comply with the requirements of said notice, the said nuisance shall be abated by the local board of health, if there be one, under the direction of the said State board [commissioner of health], immediately upon the expiration of the time fixed

[1] Ibid. (sec. 11).

[2] Called in this section "State board of health and vital statistics."

by said notice. If, however, the local board should neglect or refuse to act with due diligence, or if no such local board should exist, then the said State board [commissioner of health] shall cause said nuisance to be abated. All expenses incidental to the abatement of said nuisance shall be charged against the owner or owners of the premises whereon such nuisance exists, and a lien may be filed for the work done and materials furnished against said premises. In case of any legal proceedings under this act, the cost shall be ascertained and the liability therefor determined by and made part of the judgment or decree of the court in each case (p. 1831).

22. *When contamination does not amount to common nuisance.*—If, however, the cause of contamination by human excrement is incidental to the conduct of some legitimate business, or of a municipality, and does not amount to a common nuisance, the said board [commissioner] shall cause a petition to be presented to the court of common pleas of the county in which the said business is carried on, or the municipality is situated, asking for the abatement of the matter complained of, which petition shall set forth fully the causes for such action; and thereupon a citation shall issue to the party or parties complained of, directing them to show cause why the matter complained of should not be abated. The party or parties thus complained of shall file an answer within ten days after the service of the said citation. The matter shall then be proceeded with, and heard before the said court of common pleas, in the same manner as injunction proceedings are now conducted, and after a full hearing of the parties and witnesses, the court shall make such order as the circumstances demand (p. 1832).

24. *Act not to repeal existing laws.*—This act shall not be construed to impair or repeal any act or acts applicable to any local board of health, nor shall it impair or repeal any existing provision of law in regard to the pollution of springs, streams, ponds, water courses, or rivers, or the power and jurisdiction of any court relating to the prevention or removal of such pollution (p. 1832).

[SUPPLEMENT OF 1915; HEALTH.]

11.[1] *Regulations to be drawn up by advisory board.*—It shall be the duty of the advisory board [a board of six members appointed by the governor] * * * to draw up such reasonable orders and regulations as are deemed by said board necessary for the prevention of disease and for the protection of the lives and health of the people of the State, and for the proper performance of other work of the department of health (p. 6336).

16.[2] *General duties of commissioner of health.*—It shall be the duty of the commissioner of health to protect the health of the people of the State, and to determine and employ the most efficient and practical means for the prevention and suppression of disease[3] (p. 6337).

18.[4] *Abatement of nuisances.*—The commissioner shall have power and authority to order nuisances, detrimental to the public health, or the causes of disease and mortality, to be abated and removed, and to enforce quarantine regulations[3] (p. 6337).

---

[1] Act of Apr. 27, 1905, Public Laws (pp. 312–317, sec. 5).

[2] Ibid. (sec. 8).

[3] Secs. 16 and 18 are given because they are cited in Dixon *v.* Sheffer (24 York 141, 1910) as giving the commissioner of health power to issue an order requiring the discontinuance of a discharge of sewage into a branch of a creek, if, in his opinion, the same is a public nuisance or likely to injure the public health. As a rule general powers of this nature, which frequently give the health authorities power to prevent the pollution of streams, are omitted from this appendix. The interpretation of the law by the courts is more important than the text of the law.

[4] Act of Apr. 27, 1905, Public Laws (pp. 312–317, sec. 9).

19.[1] *Health employees may enter premises.*—If the owner or occupant of any premises, whereon any nuisance detrimental to the public health exists, fails to comply with any order of the commissioner of health for the abatement or removal thereof, the commissioner, his agents or employees, may enter upon the premises to which such order relates and abate or remove such nuisance (p. 6337).

20.[1] *Act not to apply to waters pumped or flowing from coal mines or tanneries.*—The expense of such abatement or removal shall be paid by the owner or occupant of such premises, or by the person who caused or maintained such nuisance * * * *Provided, however*, That this act shall not apply to waters pumped or flowing from coal mines or tanneries (p. 6337).

29.[2] *Violation of regulations of department of health.*—Every person who violates any order or regulation of the department of health, or who resists or interferes with any officer or agent thereof in the performance of his duties in accordance with the regulations and orders of the department of health, shall be deemed guilty of a misdemeanor, and shall, upon conviction thereof, be punished by a fine of not more than $100, or by imprisonment not exceeding one month, or both, at the discretion of the court (p. 6339).

[Digest of 1908; Ice.]

1. *Penalty for defiling ice ponds, etc.*—Any person or persons who shall willfully throw, place or cast upon the ice forming, formed or being upon any pond, stream, river, creek or canal in this commonwealth, owned or leased in whole or in part for the production of ice for sale, any timber, stone, earth or other substance, or enter upon, in anywise injure or defile the ice thereon forming, formed or being, such person or persons shall be deemed guilty of a misdemeanor, and shall and may, upon the information of any such owner, lessee, his agent or attorney, on conviction thereof before any alderman or justice of the peace in the county where the offense is committed, be fined in a sum not less than $5 or more than $50, with costs of suit; the fines to go to the school fund of the district in which the offense was committed; and in default of payment of said fine, with costs of the suit, the party convicted may and shall, by said alderman or justice of the peace, be committed to the jail of the said county, for not less than 20 nor more than 60 days, there to remain until discharged by due course of law * * * (p. 1868).

[Supplement of 1915; Municipal Corporations.]

177.[3] *Jurisdiction of municipal waterworks.*—Any city owning and operating a waterworks system is hereby authorized and empowered to enter, by any of its employees, upon private lands, through which may pass any stream or streams of water supplying such city, for the purpose of patrolling the drainage area of such stream or streams, and making investigations or inquiries pertaining to the condition of the stream or streams, sanitary or otherwise: *Provided, however*, That any injury or damage done to the property so entered upon shall be paid by such city (p. 6751).

(179–189. Under these sections the Supplement of 1915 repeats the act of April 22, 1905, Public Laws, 260–263, given above (in part) under "Gas and water companies," Supplement of 1915, sections 14–25.)

[1] Act of Apr. 27, 1905, Public Laws (pp. 312–317, sec. 9).
[2] Ibid. (sec. 16).
[3] Act of May 2, 1905, Public Laws, p. 350.

[DIGEST OF 1903; MUNICIPAL CORPORATIONS—FIRST CLASS.]

935. *Purchase of land, etc., in adjoining counties for protection of Philadelphia water supply.*—It shall be lawful for the city of Philadelphia to purchase and hold in fee simple, or for any less estate, any springs or streams of water, or any water powers or privileges, or any lands, tenements, and hereditaments, to which any springs or streams of water, or any water powers, may be appurtenant, situate, or being wholly or in part in any one or more of the counties adjoining the city and county of Philadelphia, and to build, construct, and erect thereupon waterworks, reservoirs, store lakes, ponds, etc., for the collection, purification, and preservation of the water from such springs and streams * * * (p. 2976).

939. *Penalty for corrupting waters of Schuylkill River and springs and streams leading thereto, etc.*—Any person who shall willfully destroy or injure in any manner, the pipes, aqueducts, cisterns, reservoirs, hydrants, or any of the works belonging to said city, erected in pursuance to this act [secs. 935–939], or shall willfully corrupt or otherwise render unwholesome the spring or springs, stream or streams of water, which shall be conveyed or brought into said reservoirs, works, aqueducts, etc., by said city, or shall, in any way, pollute or render noxious or offensive the said water, every such person so offending shall forfeit and pay a sum not less than $5 nor more than $100, at the discretion of the magistrate before whom sued for, and to be recovered with costs, in the corporate name of the city of Philadelphia, in the same manner as debts of $100 or under are recoverable, the one half for the use of the person who shall give information and the other half for the use of the city; and if any person, against whom such judgment shall be rendered, shall neglect or refuse to pay the amount of such judgment, and no goods or chattels of such person can be found whereof to levy the same by execution, then such person or persons shall be committed to the jail of the county, where he shall have been tried and convicted, for any period not less than 1 nor more than 50 days, at the discretion of the justice rendering such judgment, and shall moreover remain liable for the full amount of damages to the said city, in any other action instituted by the city, and shall moreover be subject to indictment for the same (p. 2975).

(942–948. Under these sections the Digest of 1903 repeats act of May 2, 1899, Public Laws, p. 176, given above (in part) under "Health," Digest of 1903, sections 19–24.)

[DIGEST OF 1903; NAVIGATION.]

2. *Casting ballast, etc., into the Delaware River.*—If any person or persons whosoever shall cast into the tideway of the River Delaware, or into the River Schuylkill, from the lower falls thereof to its junction with the River Delaware, any ballast, cinders, ashes, or any heavy article[1] whatever, from any ship, vessel, steamboat or wharf, he or they so offending, for every such offense shall forfeit and pay a sum not exceeding $100, to be sued for and recovered, with costs of suit, before an alderman of the city, or justice of the peace of the county of Philadelphia, or any court of record in this State * * * (p. 3231).

[DIGEST OF 1903; NUISANCE.]

4. *Polluting headrace of Fairmount waterworks.*—If any person or persons shall throw, cast, or willfully suffer to fall into the headrace of the waterworks

[1] Clean snow is not a heavy article contemplated by this section; but nothing should be thrown into the river that will pollute it. (War. Op. 1886, 94.)

at Fairmount, or into the water of the River Schuylkill, between the south line of Francis Street and the head arches of the said works, or into either of the reservoirs on Fairmount, any dead animal or any putrid and corrupt thing whatsoever, or any noxious or offensive matter of any kind, or if any person shall go in to swim or bathe in the said race or either of the said reservoirs or within the distance of one hundred yards of the said head arches or shall entice, throw, lead, or conduct any dog or animal therein, every such person shall forfeit and pay * * * (not less than $5 nor more than $50) (p. 3332).

5. *Throwing carrion or filth into the River Schuylkill.*—If any person or persons shall willfully take, lead, conduct, carry off, or throw, or shall cause to be taken, led, conducted, carried off or thrown into that part of the River Schuylkill which is between the dam at Flat Rock and the dam at Fairmount, near the city of Philadelphia, any carrion or carcass of any dead horse, or other animal or any excrement or filth from any slaughterhouse, vault, well sink, culvert, privy, or necessary any offal or putrid or noxious matter from any dyehouse, stillhouse, tanyard, or manufactory or any matter or liquid calculated to render the water of said river impure, every such person shall, for each and every such offense forfeit and pay a sum not less than $5 nor more than $50, at the discretion of the magistrate, to be recovered, with costs of suit, in the same manner as debts under $100 are by law recoverable, by any person who shall sue for the same before any justice of the peace within the county of Philadelphia, one-half to the use of the person prosecuting and suing, and the other half to the use of the mayor, aldermen, and citizens of Philadelphia (p. 3332).

(7. Under this section the Digest of 1903 repeats section 4 of act of April 11, 1866, Public Laws, p. 637, gven above under "Municipalities—First class," Digest of 1903, section 989.)

[Digest of 1903; Oil and Gas Wells.]

(17. Under this section the Digest of 1903 repeats section 1 of act of June 23, 1885, Public Laws 145, given above under "Crimes," Digest of 1903, section 345.)

[Supplement of 1915; Rivers.]

18.[1] *Preservation of purity of streams.* * * * It shall be unlawful for any person, partnership, or corporation to place or discharge, or permit to be placed or discharged, in or into any of the running streams of this State, any anthracite coal, anthracite culm, or refuse from anthracite coal mine, or to deposit any such coal, or culm, or refuse upon the banks of such stream, where the same would be likely to slide into or be washed into such stream: *Provided, however*, That this act shall not apply to waters pumped or flowing from coal mines where the coal or culm, or refuse have been removed therefrom; or shall not prevent the discharge of sewerage [sic] from any public sewer system, owned or maintained by any municipality in this Commonwealth (p. 7322).

19.[2] *Penalty.*—Any person, firm, or corporation violating the provisions of this act shall be deemed guilty of a misdemeanor, and shall upon conviction be punished by a fine of $100 for each offense, and a further fine of $50 per day for each day the offense is maintained, or be imprisoned not exceeding one month, or both, at the discretion of the court (p. 7323).

[1] Act of June 27, 1913, Public Laws (p. 640, sec. 1). [2] Ibid. (sec. 2).

(1–17. Under these sections Supplement of 1915 repeats act of April 22, 1905, Public Laws, pp. 260–263, given above under Gas and Water Companies, Supplement of 1915, secs. 14–25.)

(18–19. Under these sections, Supplement of 1915 repeats act of June 27, 1913, Public Laws, p. 640, given above under Rivers, Supplement of 1915, secs. 18 and 19.)

31.[1] *Water-supply commission.*—There is hereby created a water-supply commission of Pennsylvania, to consist of five members, three of whom shall, within 30 days after the passage of this act, be appointed by the governor, by and with the consent of the senate, to serve for four years from the time of their appointment, and the two remaining members of the commission shall be the commissioner of forestry and the commissioner of health, to be called and known as the water-supply commission of Pennsylvania (p. 7736).

33.[2] *Organization powers and duties.*—Immediately after the appointment and qualification of the members of the commission, they shall proceed to organize by electing a chairman and secretary. It shall be the duty of the commission to procure, as speedily as may be, all the data and facts necessary to advise them thoroughly of the situation of the water supply of the State, and adopt such ways and means of utilizing, conserving, purifying, and distributing such water supplies in such a way that the various communities of the State shall be fairly and equitably dealt with in such distribution: *Provided, however,* That the local distribution of water within the limits of an incorporated village, town or city is not to fall within the jurisdiction of this commission (p. 7736).

35.[3] *To approve waterworks plans.*—Hereafter no letters patent shall be issued to any company desiring to be incorporated for the purpose of supplying water to the public, in any community in the Commonwealth, until said application is first submitted to and has received the approval of a majority of the said water-supply commission (p. 7737).

37.[4] *Annual report.*—It shall be the further duty of the said commission to collect such information relative to the existing conditions of the water supply of the State, and to make an annual report to the governor and the legislature, based upon such investigation, recommending such future legislation as in its opinion is necessary for the conservation, development, purification, equitable distribution, and supply of the waters of the State, and in particular to such communities as are now greatly in need of extended facilities for this purpose (p. 7737).

56.[5] *Definition.*—The term "water resources," as used in this act, includes all rivers, streams, and underground waters, and all bodies of surface water, either in whole or in part, within the State (p. 7739).

57.[6] *Duties of water-supply commission.*—It shall be the duty of the water-supply commission of Pennsylvania to make a complete inventory of all the water resources of the Commonwealth; and to collect all pertinent data, facts, and information in connection therewith; and to classify, tabulate, record, and preserve the same; * * * and, generally, to devise all possible ways and means to conserve and develop the water supply and water resources of the Commonwealth for the use of the people thereof. To the end and object afore-

[1] Act of May 4, 1905, Public Laws (p. 385, sec. 1).
[2] Ibid. (sec. 3).
[3] Act of May 4, 1905, Public Laws (p. 385, sec 5).
[4] Ibid. (sec. 7).
[5] Act of July 25, 1913, Public Laws (p. 1233, sec. 1).
[6] Ibid. (sec. 2).

said, the said commission shall study, consider, and determine upon a public policy with regard * * * to the supply of water for domestic and industrial use * * * (p. 7739).

86.[1] *Limitation on appropriation of streams for water supply.*—Any city or borough desiring to erect waterworks, or to improve its water supply, may, for such purpose, appropriate springs, streams, known as rivers or creeks, lands, easements and rights of way, whether within its territorial limits or not; * * * *Provided*, That no waters or springs, appropriated under the provisions of this act, shall be used in such manner as to deprive the owner or proprietor thereof of the free use of and enjoyment of the same, at all times, for any domestic, dairy, stock, or farm purposes[2] (p. 7743).

PHILIPPINE ISLANDS.

[PENAL CODE.]

ART. 342. *Pollution of springs, cisterns, etc.*—The penalty prescribed by the next preceding article [a penalty ranging from arresto mayor in its maximum degree to prisión correccional in its minimum degree and a fine of not less than 325 and not more than 3,250 pesetas] shall also be imposed upon:

2. Any person who shall throw into any spring, cistern, or river, the water of which is used for drinking purposes, anything which makes the water dangerous to health.

ART. 581. *Befouling of watering places.*—A fine of not less than 15 and not more than 70 pesetas and censure shall be imposed upon:

5. Any person who shall throw any dead animals, garbage, or rubbish in any street or other public place where the deposit of such things is forbidden, or shall befoul any spring or watering place.

[COMPILATION OF ACTS, 1908.[3]]

728. (h) *Regulations of Philippine Health Service.*—It [Philippine Health Service] shall have power and authority to make and enforce regulations for preventing and suppressing contagious or epidemic diseases; to abate nuisances endangering the public health; to remove the cause of any special disease or mortality * * *. (Act No. 157, sec. 4, as amended by Act No. 1150, sec. 13, and Act No. 1760, secs. 7–8.)

731. *Remedying unsanitary conditions in Manila.*—The director of health shall inspect or cause to be inspected * * * waterworks, drainage and sewer systems, streams, and esteros within the limits of the city of Manila,[4] and shall cause to be prepared plans for and estimates of the cost of remedying unsanitary conditions discovered by him. * * * (Act No. 690, sec. 1, as amended by Act No. 1150, sec. 12, and Act No. 1407, sec. 5.)

733. *Ordinances to be drafted for municipal board of Manila.*—Subject to the approval of the secretary of the interior,[5] the * * * [Philippine Health Service], acting in its capacity as a local board of health for the city of Manila, shall draft and forward, through the secretary of the interior, to the municipal

[1] Act of Apr. 15, 1907. Public Laws (p. 90, sec. 1).

[2] Sec. 86 appears superseded by secs. 393 and 394 under Boroughs (act of May 14, 1915, Public Laws, p. 312, secs. 3 and 4); but it has been included in this appendix since it is given in the Supplement of 1915.

[3] As this compilation was not adopted in lieu of the original acts, the act number is given at the end of each section.

[4] The Philippine Health Service serves also as the local board of health for the city of Manila.

[5] Philippine Health Service is under the secretary of the interior.

board for enactment, health ordinances for that city. * * * (Act No. 1150, sec. 1.)

735. *Ordinances to prohibit pollution of streams, etc.*—The ordinances drafted by the * * * [Philippine Health Service] may provide for—

(*i*) Protection from infection of all public and private water supplies and sources, and prohibition of the use of water of dangerous character for domestic purposes. Ordinances enacted for the purpose of protecting the purity of the water supply of Manila shall apply to and be enforced over all territory within the drainage area of such water supply or within one hundred meters of any reservoir, conduit, canal, aqueduct, or pumping station used in connection with the city water service. (Act No. 1150, sec. 3.)

(*l*) Cleansing and preservation in a sanitary condition of the harbor of Manila, and of rivers, esteros, canals, or other waterways and their shores included within the city limits. (Act No. 1150, sec. 3.)

(*r*) Definition, declaration, and prohibition of nuisances dangerous to the public health; location and use of public drains, sewers, latrines, and cesspools, and construction and use of private drains, sewers, latrines, and cesspools. (Act No. 1150, sec. 3.)

858. *Rules and regulations.*—Subject to the approval of the secretary of the interior the director of health may make such rules and regulations as he may deem necessary * * * upon any question affecting the maintenance of public health and the suppression and extermination of epidemics of contagious, infectious, or communicable diseases of a dangerous character, and the rules and regulations thus made and approved shall have the force and effect of law: * * * (Act No. 1458, sec. 36.)

3505. *Use of poisonous substance in taking fish.*—The use of any poisonous substance liable to cause the death of fishes for the taking of the same, or the placing of any such substance in fresh or marine waters of the Philippine Islands, where it may cause the death of fishes and is intended to cause such death, shall be unlawful: *Provided*, That the secretary of the interior may issue permits for the use of poisonous substances in taking fish in limited numbers for scientific purposes only. (Act No. 1499, sec. 2, as amended by act No. 1685, sec. 2.)

3506. *Penalty.*—Any person violating the provisions of sections 3504 to 3507, inclusive, hereof shall, for each offense, be punished by a fine of not more than ₱200 or by imprisonment for not more than six months, or by both such fine and imprisonment, in the discretion of the court. All * * * poisons, boats, tackle, apparel, furniture, or other apparatus used to aid in the violation of said sections shall be forfeited to the government. * * * (Act No. 1499, sec. 3.)

3507. *Disposition of fine.*—The person giving information that has led to the conviction of any person under the provisions of this and the last three preceding sections shall receive one-half the fine imposed, and it shall be the duty of the court in rendering the judgment of conviction to ascertain and declare the name of the informer entitled to receive one-half of the fine imposed. (Act No. 1499, sec. 4.)

[Act No. 2468, 1915.]

Sec. 3. *Regulations for public water supplies, etc.*—The powers, duties, and jurisdiction of the council of hygiene [of the Philippine Health Service] shall be as follows:

(*f*) To propose regulations on hygiene or sanitation relative to * * * factories, mills, * * * public water supplies, public bathhouses, wells, cisterns, cemeteries, * * *.

SEC. 11. *Duties of Philippine Health Service.*—All medical, surgical, and sanitary work of a public nature, which is supported from the founds [sic] of the Philippine Islands, shall hereafter be performed by the Philippine Health Service:[1] *Provided*, That nothing in this section shall be construed as in any way curtailing or infringing upon the activities of the University of the Philippines in its educational work, the activities of the bureau of science, or those of the medical division of the Philippine constabulary, or of the maritime quarantine service, as now provided for by law or regulations.

SEC. 13. *Duties of director of health.*—* * * He [the director of health] shall perform all the duties and functions, and exercise all the powers, not in conflict with this act, which are now reposed in the director of health, or which may hereafter be conferred upon him by law.

[ACT. No. 2590. 1916.]

SEC. 15. *Depositing of trade wastes, etc., into waters of Philippine Islands.*—It shall be unlawful to place, cause to be placed, discharge or deposit, or to pass or place where it can pass into the waters of the Philippine Islands any petroleum, acid, coal or oil tar, lampblack, aniline, asphalt, bitumen or residuary product of petroleum, or carbonaceous material or substance, or any refuse, liquid or solid, from any oil refinery, gas house, tannery, distillery, chemical works, mill, or factory of any kind, or any sawdust, slabs or factory refuse, or any material substance deleterious to fish or plant life: *Provided*, That nothing contained in this section shall be construed to prohibit the retting of maguey, sisal, sansevieria, and its similars in the rivers and on the seashore.

SEC. 17. *Penalty.*—Any person violating this act or any order or regulation deriving force from its provisions shall be punished for each offense by a fine of not more than ₱100.

PORTO RICO.

[REVISED STATUTES AND CODES, 1911.]

119. *Throwing carcasses of diseased animals in rivers.*—Every person who knowingly throws or places, or causes to be thrown or placed, in any river, stream, canal, or other running water, or any lake, or into the sea within 10 miles of the shore, the carcass of an animal which has died of disease, or which has been slaughtered as diseased, or suspected of disease, shall be deemed guilty of a misdemeanor and upon conviction thereof shall be subject to a fine of not exceeding $200, or imprisonment for one month in jail, or to both fine and imprisonment. (Laws, 1907, p. 85, sec. 5.)

498. *Depositing mud, etc., in harbors.*—No person or persons shall deposit in any harbor stones, gravel, ballast, cinders, ashes, dirt, mud, or any other substance, under penalty of a fine not exceeding $500, or imprisonment in jail not exceeding six months. (Laws, 1906, p. 47, sec. 7.)

2390. *Public waters defined.*—The following are public or of public ownership:

1. Waters which rise continuously or intermittently on lands of public ownership.

2. Continuous or intermittent waters of springs and creeks which run through natural channels.

3. Rivers. (Law of Waters, 1879,[2] art. 4.)

[1] This act establishes the Philippine Health Service in place of the previous board of health.

[2] Promulgated in Porto Rico in 1886.

2512 (as amended by Laws, 1915, p. 53). *Use of running waters for domestic purposes.*—Any person may make use of the waters running along the natural and public channels for drinking purposes or for washing clothes, vessels, and other objects, for bathing or for watering or bathing horses and cattle, subject to police, sanitary, and other regulations and laws. * * * (Law of Waters, 1879, art. 126, as amended by Laws, 1915, p. 53.)

2514. *Washing of clothes in canals, ditches, etc., if use of water does not necessitate state of purity.*—* * * all persons may wash clothing, vessels, or other objects in canals, ditches, or uncovered aqueducts of public waters, even though they be the temporary property of the grantees, provided the margins are not injured thereby and that the use to which the water is put does not require that it be in a state of purity. But cattle or horses shall be bathed or watered only at the places set aside for this purpose. (Law of Waters, 1879, art. 128.)

2605. *Pollution of waters by industrial establishments.*—If an industrial establishment shall communicate to the waters substances or properties injurious to health or vegetation, the governor of the Province shall order a technical examination made, and if the damage be established he shall order that the industrial work be suspended until the owners thereof adopt the proper remedy. The fees and cost of the examination shall be defrayed by the person making the complaint if it should be found to be groundless and otherwise by the owner of the establishment.

If the owner or owners should not have adopted the proper remedy within a period of six months, it shall be understood that they desire to discontinue the operation of their industry. (Law of Waters, 1879, art. 219.)

2606. *Grants for use of waters by industries may be revoked where waters become polluted.*—Grants for the use of public waters by industrial establishments shall be made in perpetuity and under the condition that if at any time the waters acquire properties prejudicial to health or vegetation by reason of the industry for which they were granted the forfeiture of the grant shall be declared without any right to indemnity by reason thereof. (Law of Waters, 1879, art. 220.)

2608. *Waters may be used for fish hatcheries, etc., if health or lower uses of waters are not injured.*—The Governor General may grant the use of public waters for the purpose of forming lakes, pools, or reservoirs intended for fish ponds or hatcheries, provided no injury is caused to health or to other lower uses under prior acquired rights. (Law of Waters, 1879, art. 222.)

2618. *Jurisdiction over private waters.*—With regard to waters of private ownership, the administration shall confine itself to exercising over the same the necessary surveillance to prevent any danger to public health or to the security of persons and property. (Law of Waters, 1879, art. 227.)

5422. *Penalty for misdemeanors.*—Except in case where a different punishment is prescribed by this code [Penal Code], every offense declared to be a misdemeanor is punishable by imprisonment in jail not exceeding two years or by a fine not exceeding $250, or by both. (Penal Code, sec. 16.)

5642. *Penalty for poisoning water supplies.*—* * * every person who willfully poisons any spring, well, or reservoir of water is punishable by imprisonment in the penitentiary for a term not less than one nor more than 10 years. (Penal Code, sec. 221.)

5777 (as amended by Laws, 1912, p. 103). *Definition of nuisance.*—Anything which is injurious to health * * * or is an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property by an entire community or neighborhood, or by any considerable number of

persons, or unlawfully obstructs the free passage or use, in the customary manner, of any navigable lake, river, bay, stream, canal, or basin, * * * is a public nuisance, * * *. (Penal Code, sec. 329, as amended by Laws, 1912, p. 106.)

5778. *Penalty for maintaining public nuisance.*—Every person who maintains or commits any public nuisance the punishment for which is not otherwise prescribed, or who willfully omits to perform any legal duty relating to the removal of a public nuisance, is guilty of a misdemeanor. (Penal Code, sec. 330.)

5780. *Prohibiting placing dead animals in watercourses.*—Every person who puts the carcass of any dead animal, or the offal or filth from any slaughterhouse, pen, or butcher shop, into any river, creek, pond, reservoir, stream, * * * and any person who puts any filth or carcasses of any dead animal or any offal of any kind in or upon the borders of any stream, pond, lake, or reservoir, from which water is drawn for the supply of the inhabitants of any city, village, or municipality, so that the drainage from the filth, carcass of any animal, or offal of any kind may be taken up by or in such stream, lake, or reservoir, or who by any other means fouls or pollutes the waters of any such stream, pond, lake, or reservoir, is guilty of a misdemeanor, and upon conviction shall be punished by imprisonment in jail not exceeding one year or by fine not exceeding $1,000, or by both fine and imprisonment, in the discretion of the court. (Penal Code, sec. 332.)

5809. *Violation of sanitary rules and regulations.*—Every person * * * who shall violate any * * * sanitary or other regulations issued by the director of health, charities, and corrections, or by any other person, body, or board always under authority of law, shall be guilty of a misdemeanor, and shall be punishable accordingly. (Penal Code, sec. 357, as amended by laws, 1911, p. 68.)

5964. *Putting filth into canals and reservoirs.*—Every person * * * who shall empty or place, or caused [sic] to be emptied or placed, into any such canal, ditch, flume, or reservoir [used for conveying water for manufacturing, agricultural, irrigating, generation of power, or domestic purposes] any rubbish, filth, * * * is guilty of a misdemeanor. (Penal Code, sec. 510.)

[LAWS, 1912, P. 125.]

SEC. 12. *Sanitary rules and regulations.*—It shall be the duty of the insular board of health to act as an advisory and legislative body in respect to all matters pertaining to the public health, and it shall prescribe all sanitary rules, regulations, and ordinances required by this act, which shall govern in all the municipalities of Porto Rico, with a view to preventing and suppressing contagious and epidemic diseases, * * * and dealing with any other service affecting public health, such as the water service, * * * drainage, * * * factories and workshops, * * * cleaning of cesspools and sinks, * * * cemeteries, * * *. It shall * * * prescribe rules and regulations for * * * guarding from contamination all streams from which water for drinking or domestic purposes is taken.

SEC. 13. *Approval of executive council required—Promulgation of rules and regulations.*—* * * All such rules and regulations, when approved by the executive council, shall be promulgated by the governor of Porto Rico and shall be published in two newspapers of general circulation in the island, and thereupon and thereafter shall have the force and effect of law.

SEC. 14. *If the insular board fails to prescribe rules and regulations.*—In the event that the insular board of health should at any time fail or unreasonably delay to prescribe the sanitary rules and regulations required by this act,

then it shall be the duty of the executive council, when such failure is brought to its attention by the governor, to formulate the necessary sanitary rules and regulations as herein provided, * * *.

SEC. 15. *Courts to take notice of adoption and publication.*—All courts are required to take judicial notice of the adoption of such rules and regulations and of the publication thereof required by this act.

SEC. 33. *Penalty for violation of the rules and regulations.*—Any person violating any sanitary regulation put in force as herein provided shall be punished by a fine of not less than $1 nor more than $100 or by imprisonment from 1 to 30 days or with both penalties, at the discretion of the court.

[64TH U. S. CONGRESS, SESS. II., CHAP. 145.]

SECTION 1. *To whom act applies.*—The provisions of this act shall apply to the Island of Porto Rico and to the adjacent islands belonging to the United States, and waters of those islands; and the name Porto Rico as used in this act shall be held to include not only the island of that name but all the adjacent islands as aforesaid.

SEC. 13. *Department of health created.*—The following executive departments are hereby created: * * * a department of health, the head of which shall be designated as the commissioner of health.

SEC. 19. *Duties of commissioner of health.*—The commissioner of health shall have general charge of all matters relating to the conduct of maritime quarantine, and shall perform such other duties as may be prescribed by law.

[REGULATIONS, INSULAR BOARD OF HEALTH, JAN. 28, 1913.]

SEC. 15. *Requirement in regard to water-closets, cesspools, etc.*—In towns provided with aqueducts, sewers, or sewerage system, all houses and edifices must be provided with water-closets which have been approved and have therefore been accepted as serviceable and which have free discharge into the said sewer, to the exclusion of any other system of latrine. In towns not provided with aqueducts or sewerage system and where cesspools have to be used, the same shall be built at a distance of not less than 10 meters from wells, cisterns, bedrooms, and kitchens, or as far as possible therefrom within the limits of the property, but the director of sanitation shall be notified in order that he may dictate in each case the requirements of such construction. Said cesspools shall be kept proof against inundations from rainfall. In both cases said installations shall fulfill the requirements set forth in the regulations governing plumbing, approved September 5, 1912.

SEC. 16. *Cleaning and disinfecting of cesspools.*—The owner or agent of any house or edifice must have drains and cesspools cleaned before they get too full and overflow. He shall also see that said drains and cesspools are treated with quicklime, calcium chloride, creoline, or any other disinfectant, when the service of sanitation shall, for any special reason, so require it. He shall also see that any deficiencies in the construction of water-closets, latrines, drains, or cesspools which may be the cause of troublesome emanations be corrected.

RHODE ISLAND.

[GENERAL LAWS, REVISION OF 1909, CHAP. 118.]

1 (as amended by Public Laws of 1911, chap. 683). *Pollution of streams, etc.*—No person shall throw or discharge, or suffer to be thrown or discharged into any well, spring, brook, lake, pond, reservoir, or stream used as a source

of water supply for drinking purposes by any city, town, district, institution, or company, or into any known tributary or feeder of any such well, spring, brook, lake, pond, reservoir, or stream, any sewerage [sic], drainage, refuse, or other noxious matter or thing tending to pollute or corrupt, or impairing or tending to corrupt the purity of the waters of any such well, spring, brook, lake, pond, reservoir, or stream, or any known tributary or feeder thereof, or render the same injurious to health, which waters shall be of the recognized standard of purity to be determined by the State board of health or other recognized authority; or bathe or wash any animal, clothing, or any other article in any such well, spring, brook, lake, pond, or reservoir: *Provided, however*, That the provisions of this section shall not interfere with nor prevent the enriching of land for agricultural purposes by the owner or occupant thereof if no human excrement is used thereon. Any person violating any of the provisions of this section shall be punished for each offense by a fine of not exceeding $50, or by imprisonment for a term not to exceed 30 days, or both.

2. *Powers and duties of the State board of health under this chapter.*—The State board of health or the secretary of said board, when satisfied that any sewerage [sic], drainage, or refuse or polluting matter exists in a locality such that there is danger that said sewerage, drainage, or refuse or polluting matter may corrupt or impair the quality of said waters or render them injurious to health, may order the owner or occupant of the premises where said sewerage, drainage, or refuse or polluting matter exists to remove the same from said premises within such time after the serving of the notice prescribed in the next succeeding section as said board or secretary may designate; and if the owner or occupant neglects or refuses so to do he shall be fined $20 for each day during which he permits said sewerage, drainage, or refuse or polluting matter to remain upon said premises after the time prescribed for the removal thereof.

3. *How notice is to be given, etc.*—Such notice shall be in writing, signed by the secretary of the State board of health or the person performing the duties of that official, and shall be served by any sheriff, deputy sheriff, or constable by reading the same in the presence or hearing of the owner, occupant, or his authorized agent, or by leaving a copy of the same in the hand or possession of, or at the last and usual place of abode of, said owner, occupant, or agent if within this State: *Provided, however*, That if said owner, occupant, or agent be a corporation incorporated in this State, said notice shall be served by leaving a copy thereof at the last and usual place of abode of the president or person performing the duties of president of said corporation. But if said premises are unoccupied, or the residence of the owner is unknown or without this State, or if the said owner is a corporation incorporated without this State, the notice may be served by posting a copy of the same on the premises and by advertising the same in some newspaper published in Providence County in such manner and for such length of time as the State board of health or the secretary thereof may determine.

4. *Prosecution.*—The secretary of the State board of health, when so directed by said board, shall prosecute for all violations of this chapter and shall not be required to give surety for costs upon complaints made by him; but the cities of Woonsocket and Pawtucket and the towns of Bristol and East Providence shall be directly liable to the State for the costs incurred in the prosecution for violation of this chapter in their respective cases.

5 (as amended by Public Laws of 1911, chap. 683). *Court jurisdiction.*—The superior court, upon the application of the mayor of any city, or the president of the town council of any town, or the executive officer of any district, institution, or company interested shall have jurisdiction in equity to enjoin the violation

of any of the provisions of this chapter and to enforce the orders of the State board of health, or of the secretary thereof, provided for in this chapter.

[GENERAL LAWS, REVISION OF 1909, CHAP. 144.]

6. *Escape of noxious material used in manufacture of gas into certain rivers.*—No person or corporation shall deposit in, or allow to escape into, or shall cause or permit to be deposited in, or allowed to escape into, the waters of Providence or Warren Harbors or Providence or Warren Rivers, any material used in connection with, or product of, the manufacture of gas, which may cause disagreeable odors or defile the surface of vessels, boats, or other property, or the shores of said Providence or Warren Harbors or Rivers, or injure the healthy growth of fish or shellfish in said waters. Every person or corporation violating the provisions of this section shall be fined for each offense $100, one-half thereof to the use of the State and one-half thereof to the use of the complainant. It shall be the duty of the harbor commissioners to prosecute cases under complaints brought in accordance with this section.

11. *Dumping places in public tidewaters.*—They [harbor commissioners] shall regulate the depositing of mud, dirt, and other substances in the public tidewaters of the State, and shall prescribe the places where the same may be deposited; and every person who shall place or deposit mud, dirt, or other substances in said waters without obtaining proper authority therefor, shall be fined for each offense $100, one-half thereof to the use of the State and one-half thereof to the use of the complainant.

17. *Waters excluded from provisions of section 11.*—The waters immediately bordering on the towns in the county of Newport, extending to and including ship channel, and the harbors in said county, excepting the waters immediately bordering on Prudence Island, are hereby exempted from the provisions of the preceding nine sections of this chapter.

[GENERAL LAWS, REVISION OF 1909, CHAP. 206, AS AMENDED BY PUBLIC LAWS OF 1912, CHAP. 577.]

1. *Substances injurious to shellfish not to be deposited in public waters.*—No person shall deposit in, or allow to escape into, or shall cause or permit to be deposited in, or allowed to escape into any of the public waters of this State, any substance which shall in any manner injuriously affect the growth or sale of the shellfish in or under said waters, or which shall in any manner affect the flavor or odor of such shellfish so as to injuriously affect the sale thereof, or which shall cause any injury to the public and private fisheries of this State.

2. *Penalty.*—Any person violating any of the provisions of this chapter shall, upon conviction thereof, be fined not less than $500 or more than $2,000, one-half thereof to the use of the complainant and one-half thereof to the use of the State: *Provided*, That in case of conviction upon prosecution by the commissioners of shell fisheries the whole of any fine imposed shall go to the use of the State.

3. *Civil damages.*—Every person violating any of the provisions of this chapter shall be liable to pay, to the party injured by such violation, double the amount of damages caused thereby, to be recovered in any action of the case in any court of competent jurisdiction. It shall not be necessary, before bringing suit for the recovery of such damages, for a criminal prosecution to have been first instituted for the violation of the provisions of this chapter, nor shall the recovery of damages under this section be a bar to such criminal prosecution.

9. *Inspection to determine sanitary condition of shellfish grounds.*—Said commissioners [commissioners of shellfisheries] shall inspect any or all the leased oyster grounds and other shellfish grounds within the State, at such times as they may deem advisable, to determine whether said grounds are in a proper sanitary condition for the production of shellfish for consumption as food.

[GENERAL LAWS, REVISION OF 1909, CHAP. 207.]

33. *Depositing of substances injurious to fish in streams and fresh water forbidden.*—No person shall place, deposit * * * any substance injurious to the health or life of fish in any stream or fresh-water pond within this State. * * * Every person violating any of the provisions of this section shall for each offense be fined not exceeding $20 or be imprisoned not exceeding 30 days, or be both fined and imprisoned.

[GENERAL LAWS, REVISION OF 1909, CHAP. 211.]

1. *Depositing fish offal and certain trade wastes in tidewaters forbidden.*—Every person who shall throw into or deposit in, or cause to be thrown into or to be deposited in, any of the public tidewaters of the State or upon the shores of any such tidewaters any fish offal or any water impregnated with fish, unless the same be filtered in such manner as may be determined by the town council of the town wherein such deposit shall be made, and every person who shall cause any deleterious substance, resulting from the smelting or manufacture of copper or from other manufactures or from other sources which is destructive to fish or which repels them coming into the said public waters or which shall do anything which tends to drive them therefrom, to be emptied, deposited, or run into the said public waters shall forfeit $100.

2. *Craft on which violations of chapter occur liable.*—Every vessel, craft, boat, or floating apparatus employed in the procuring of fish oil or in the dressing of bait for the mackerel fisheries or the dressing of fish for other purposes in violation of this chapter shall be liable for any forfeiture and costs resulting from prosecution hereunder and the same may be attached on the original writ and held as other personal property attached may be held to secure any judgment which may be recovered in any action brought to enforce any such forfeiture; and any person upon view of any offense in violation of this chapter may seize and detain any vessel, craft, boat, or floating apparatus, the same to be detained for a period not exceeding six hours.

3. *Penalty for boiling menhaden on vessels in tidewater.*—Every person who shall boil any menhaden fish or press any fish for the purpose of extracting oil therefrom on board of any vessel on any of the public tidewaters shall be fined not exceeding $50.

[GENERAL LAWS, REVISION OF 1909, CHAP. 248.]

16. *Poisoning springs, etc.*—* * * every person who shall willfully poison any spring, well, or reservoir of water with such intent (to kill or injure any person), shall be imprisoned for life or for any term of years.

[PUBLIC ACTS OF 1915, CHAP. 1278.]

SEC. 6. *Damages for pollution of waters in constructing Providence waterworks.*—* * * Relative to the work of construction of such reservoir or reservoirs or any works connected therewith [the act concerns the construction of waterworks, etc., for the city of Providence], said city shall not do,

or cause or suffer to be done, any act or thing which would result in the waters of said branch [north branch of Pawtucket River] being polluted to any greater extent than said waters would have been polluted without such construction work, and in case it fails to observe this provision, any person or corporation owning or operating any manufacturing establishment on said branch may recover its damages suffered thereby in an action of the case in any court of competent jurisdiction. * * *

SEC. 13. *Removal of cemeteries which would pollute water supply.*—In case any lands acquired by purchase or condemnation hereunder contain any burial ground, cemetery, graves, or places of human burial, and if any such places are to be flowed by water or are located so near to any such reservoir or waterway as to be liable to pollute or reduce the quality or value of any such waters as a potable water supply, said city shall remove the remains found in any such burial places. * * * Nothing in this act shall permit the condemnation of any lands, or of any estate, rights, or interests in any lands included within the present fence lines of the Glenwood Cemetery, situated in North Scituate, south of said Main Street * * *.

SOUTH CAROLINA.

[CIVIL CODE, 1912.]

1599 (as amended by Acts, 1917, p. 39). *Every water company to have analysis of water made.*—Every water company, whether owned by private individuals or corporations or by a municipality, shall have made, not less frequently than once in every three months, at its own expense by a chemist to be approved by the State board of health, a chemical analysis, and once every three months a bacteriological examination at its own expense by a biologist to be approved by the State board of health, of a sample of its water drawn from a faucet used for drinking purposes, packed and shipped in accordance with the instructions to be furnished by the secretary of the State board of health, and the result of such examination shall be verified by a statement under oath of the chemist or biologist making the same, and published at least once in a newspaper published in the town or city using said water, within ten days after receipt thereof: *Provided*, That in the town of Manning the said examination and analysis shall be made at least once in every year.

1601. *Water sheds to be inspected.*—As a check and as a guarantee of the faithful performance of the requirements laid down in this article [boards of health, under Title VIII, "Of the public health"] the State board of health shall make or have made by its authorized agents, such inspections of the watersheds and such chemical and bacteriological examinations of the public water supplies of the State as may be deemed necessary to insure their purity. Should such inspections or examinations show condition or conditions dangerous to the public health, the secretary of the State board of health shall notify the mayor, the municipal health officer, and the superintendent or manager of the waterworks at fault, and demand the immediate removal of said dangerous condition or conditions. If at the end of 30 days after the service of said notice and demand, the said dangerous condition or conditions shall have not been removed to the extent that due diligence could accomplish such removal, the said secretary shall have printed in one or more of the local newspapers a plain statement of the facts for the information and protection of the citizens using the water: *Provided*, That nothing herein contained shall be construed to prohibit any municipality from imposing such additional tests and require-

ments as they may deem necessary, and the decision of the municipal authorities shall be supreme.

3027 (as amended by acts of 1916, p. 941). *Municipalities may enter lands, etc., to protect water supplies.*—* * * They [municipal corporations establishing or enlarging waterworks] shall also have the right to enter upon and condemn lands and tenements for the purpose of protecting the watersheds from contamination, nuisances, or any conditions which may be a menace to the public health, upon proper compensation being first made to the owner thereof.

[CRIMINAL LAW, 1912.]

404. *Penalty for violation of law regarding analyses and inspections of water supplies.*—* * * [Secs. 1599, 1600, and 1601 of the Civil Code, 1912, are given unaltered as a part of this section.][1] Every water company, its managing officers and directors, and the mayor and aldermen of every city and town, who shall neglect or fail to comply with and carry out the provisions of this section, shall be guilty of a misdemeanor, and punished by a fine not exceeding $100, or by imprisonment not exceeding 30 days for each and every offense.

757. *Unlawful to poison streams.*—It shall be unlawful to poison the streams or waters of the State in any manner whatsoever for the purpose of taking fish. The muddying of streams or ponds or the introduction of any substance which results in making the fish sick, so that they may be caught, is hereby declared to be poisoning in the sense of this act. (Acts of 1910, p. 576.) * * * For violation of this section the person or persons so violating shall be fined $500, or imprisoned one year.

764. *Poisoning fish in artificial private ponds.*—Whenever any one shall have made or created an artificial pond on his own land, and shall put therein any fish, or the eggs of any fish or oysters, for the purpose of breeding and cultivating fish or oysters, and shall give notice thereof, by written or printed handbills, put up in public places near the said pond, any person or persons who * * * shall be guilty of committing any trespass upon any artificial fish pond by * * * poisoning the same, * * * upon conviction shall be deemed guilty of a misdemeanor and shall be subject to a fine of not less than $20 nor more than $100, or be imprisoned at the discretion of the court; which fine, if imposed, shall go one-half thereof to the informer and the other half thereof to the person or persons whose property shall have been injured: *Provided*, That nothing in this section shall be construed as applying to ponds used as water power for manufacturing purposes.

772. *Impurities not to be cast into fish streams.*—Should any person or persons cause to flow into or be cast into any of the creeks, streams, or inland waters of this State, any impurities that are poisonous to fish or destructive to their spawn, such person or persons shall, upon conviction thereof, be punished with a fine of not less than $500, or imprisonment of not less than six months in the county jail; the fine to go one-half to the informer and the other half to the county.

[ACTS OF 1912, P. 744.]

SECTION 1. *Executive committee of State board of health to make and enforce rules for public health.*—The executive committee of the State board of health shall have the power to make, adopt, promulgate, and enforce reasonable rules and regulations from time to time * * * to regulate the methods of disposition of garbage or sewage and any like refuse matter in or near any incor-

[1] See above for sections 1599 and 1601.

porated town, city, or unincorporated town or village of the State; to provide for the thorough investigation and study of the causes of all diseases, epidemics and otherwise in this State, * * * to make separate orders and rules to meet any emergency not provided for by general rules and regulations, for the purpose of suppressing nuisances dangerous to the public health and communicable, contagious, and infectious diseases and other dangers to the public life and health: *Provided, however*, That nothing herein contained shall be construed as in anywise limiting any duty, power, or powers now possessed by or heretofore granted to the said State board of health or its executive committee by the statutes of this State, or as affecting, modifying, or repealing any rule or regulation heretofore adopted by said board.

SEC. 2. *Penalty for violation of rules.*—Any person who shall, after notice, violate, disobey, refuse, omit, or neglect to comply with any rule of said executive committee of the State board of health, made by it in pursuance of this act, shall be guilty of a misdemeanor, and, upon conviction thereof, shall be fined not exceeding the sum of $100, or be imprisoned for 30 days: * * *.

SOUTH DAKOTA.

[REVISED POLITICAL CODE, 1903.]

1229. *Depositing of offal and emptying of sewage into streams, etc.—Power of city.*—The city council shall have the following powers:

15. To regulate and prevent the throwing or depositing of ashes, offal, dirt, garbage, or any offensive matter * * * into any stream of water within the city limits or forming the boundary thereof * * *.

73. To construct and maintain sewer pipes through and upon private property, or in or along any stream of water, or to empty or discharge the sewerage [sic] of the city or any part thereof into any stream of water within or without the limits of the city, and for that purpose may condemn private property when necessary: *Provided*, That sewerage [sic] so emptied into any stream of water shall be so disposed of and managed as not to create any foul or noxious odors in the air over or along such stream.

1438. *Emptying of sewage into streams by towns.*—The board of trustees (of towns) shall have the following powers, viz:

24 (added by Session Laws of 1909, chap. 50). * * * to empty or discharge the sewage of the town or any part thereof into any stream of water within or without the limits of the town * * *: *Provided*, That sewage so emptied into any stream of water shall be so disposed of and managed as not to create any foul or noxious odors in the air over or along such stream.

2567. *Deterioration of water used for mining, domestic, etc., purposes not to affect rights of prior appropriator.*—The waters of the streams or creeks of the State may be made available to the full extent of the capacity thereof for mining, milling, agricultural or domestic purposes, without regard to deterioration in quality * * * so that the same do not materially affect or impair the rights of the prior appropriator.

[REVISED CIVIL CODE, 1903.]

278 (as amended by chapter 305, Session Laws of 1915). *Owner of land over which stream runs may not pollute water.*—The owner of the land owns water standing thereon, or flowing over or under its surface, but not forming a definite stream. Water running in a definite stream, formed by nature over or under the surface, may be used by him as long as it remains there; but he may not * * * pollute the same. * * *

[REVISED PENAL CODE, 1903.]

416. *Poisoning springs prohibited.*— * * * every person who willfully poisons any spring, well, or reservoir of water is punishable by imprisonment in the State prison not exceeding ten years, or in a county jail not exceeding one year, or by a fine not exceeding $500, or by both such fine and imprisonment.

445. *Polluting streams with certain trade wastes prohibited.*—Every person who throws or deposits any gas tar, or refuse of any gas house or factory, into any public waters, river, or stream, or into any sewer or stream emptying into such public waters, river, or stream, is guilty of a misdemeanor.

446. *Depositing of offal, carcasses, etc., in streams or on banks prohibited.*—It shall be unlawful for any person, persons, company, or corporation to place or cause to be placed any manure, butcher's offal, carcasses of animals, or other deleterious substances into any river, stream, or lake in the State of South Dakota, or upon the banks thereof in such proximity that such substances may be washed into said water or watercourses.

447. *Penalty.*—Any violation of the provisions of this chapter [chap. 38, of crimes against the public health and safety, Revised Penal Code, 1903, secs. 441–489], is a misdemeanor, and the person, persons, company, or corporation so violating are deemed guilty thereof, and upon conviction shall be liable to a fine not less than $10 nor more than $100, and in addition thereto such offending person or persons shall be subjected to imprisonment in the county jail for the period of 30 days, unless he or they cause such deleterious substances to be removed.

456. *Violation of health laws or regulations.*—Every person who willfully violates any provision of the health laws, the punishment for violating which is not otherwise prescribed by those laws, or by this code, and every person who willfully violates or refuses or omits to comply with any lawful order, direction, prohibition, or regulation prescribed by any board of health or health officer, or any regulation lawfully made or established by any public officer under authority of the health laws, is punishable by imprisonment in a county jail not exceeding one year, or by a fine not exceeding $2,000, or both.

[SESSION LAWS OF 1913, CHAP. 109.]

SEC. 4 (as amended by Session Laws, 1917, chap. 353). *Regulations of State board of health.*—The said board [board of health and medical examiners] * * * shall have power as follows:

(2) To adopt, alter, and enforce reasonable regulations of permanent application throughout the whole or any portion of the State, or for specified periods in parts thereof, for the preservation of public health. Upon the approval of the attorney general and the due publication thereof, such regulations shall have the force of law, except insofar as they may conflict with a statute or with the charter or ordinances of a city of the first class upon the subject, and in and by the same the board may control, by requiring the taking out of licenses and permits, or by other appropriate means, any of the following matters:

(*b*) The business of scavengering and the disposal of sewage.

(*c*) The pollution of streams and other waters and the distribution of water by private persons for drinking or domestic use.

(*h*) The accumulation of filthy and unwholesome matter, to the injury of the public health, and the removal thereof.[1]

[SESSION LAWS OF 1913, CHAP. 119.]

SEC. 53. *Board of commissioners have power to prevent throwing offal, etc., into streams.*—The board of commissioners [in cities under commission] shall have the following powers:

16. To regulate and prevent the throwing or depositing of ashes, offal, dirt, garbage, or any offensive matter * * * into any stream of water within the city limits or forming the boundary thereof * * *.

[SESSION LAWS OF 1913, CHAP. 213.]

SEC. 4. *Use of poisonous substances, etc., for taking of fish prohibited.*—It shall be unlawful for any person to take, in any permanent waters of this State, for any purpose, any trout or food fish at any time by the use of any poisonous or deleterious or stupefying drug * * *.[2]

[SESSION LAWS OF 1915, CHAP. 200.[3]]

SEC. 4. *Dumping of sawdust into trout streams, etc., prohibited.*—* * * And it shall be unlawful for any person to empty or allow to be emptied, place or allow to be placed, any sawdust, manure, or refuse matter of any kind into the waters of this State containing trout or food fish, or deposit the same within such distance that it may be carried into such waters by natural causes; * * *

SEC. 5. *Penalty.*—Any person violating any of the provisions of the four preceding sections shall be deemed guilty of a misdemeanor, and upon conviction shall be punished by a fine of not less than $10 nor more than $100, or by imprisonment in the county jail not exceeding 30 days, or by both such fine and imprisonment.

[POLLUTION OF STREAMS, LAKES, AND OTHER BODIES OF WATER. REG. 174, BD. OF H. JULY 16, 1915.]

1. No sewage, drainage, domestic, factory, or industrial refuse, excremental or other polluting matters of any kind whatsoever, which, either by itself or in connection with other matter, corrupts or impairs or tends to corrupt or impair, the water so as to render its use, or the use of ice formed therefrom, detrimental or dangerous to health, shall be placed in or discharged into any river, brook, stream, or tributary branch thereof, or of any lake, pond, or other public

[1] Sec. 28 of this act reads: "Secs. 238 and 245, both inclusive, * * * of the Revised Political Code of 1903 * * * are hereby repealed." This is taken to mean secs. 238 to 245, inclusive (as amended by chap. 217, Session Laws of 1903). All of these sections conflict with the new law.

[2] See footnote to chap. 200, Session Laws of 1915.

[3] At the present time there are in force two other laws covering what is given in sec. 4 of this law (1) sec. 3100 of Revised Political Code of 1903, as amended by chap. 112, Session Laws of 1905, and chap. 91, Session Laws of 1909, and (2) chap. 213, Session Laws of 1913, sec. 4. Sec. 3100, as amended, is therefore omitted, and only a part (which appeared in sec. 3100, as amended, but has been omitted from the 1915 law) is given in the case of the 1913 law. As this clause does not conflict with the 1915 law, it would appear to be in force. The penalty for the 1913 law is identical with that for the 1915 law and is therefore omitted.

stream or body of water, within or abounding the State of South Dakota, from which water or ice is, or may be, taken for domestic purposes.

2. No sewage, drainage, domestic, or industrial refuse, excremental, or other polluting matters of any kind whatsoever, which, either by itself or in connection with other matter, corrupts or pollutes, or tends to corrupt or pollute the water thereof, shall be placed in or discharged into any river, brook, stream, or of any tributary or branch thereof, or of any lake, pond, or other public stream or body of water within or bounding the State of South Dakota, so as to render same injurious or dangerous to the public health.

3. Complaint may be made to the State board of health of the violation of the provisions of the foregoing regulations. Whenever the county board of health of any county of the State or the health officer or board of any city or town of the State, or 10 per cent of the electors of any county, city, or town of the State, shall file with the State board of health a complaint in writing, setting forth that the waters of any river, brook, stream, or tributary or branch thereof, or of any lake, pond, or other public stream or body of water are corrupted, impaired, or polluted as prohibited in the foregoing sections, and specify the causes thereof, the State board of health, if it deems such complaint sufficient and warranted, will make an order appointing a hearing thereon, and the superintendent shall give such notice of said hearing by posting, publishing, or otherwise, as the board by its order shall prescribe. At such hearing any party interested may appear and be heard with reference thereto. The State board of health will thereupon make its findings, and with the approval of the attorney general make such regulations and directions as shall be required to prevent the corruption and pollution of said waters.

4. The State board of health will proceed of its own motion, when deemed necessary to protect the public health, to investigate alleged pollution of streams or public waters of the State, whether with or without a hearing, as the board deems best, and make, with the approval of the attorney general, such regulations as it deems necessary in any such case.

[Disposal of Creamery Waste. Reg. Bd. of H., July 25, 1913.]

117. Creamery waste or washings must not be discharged upon the surface of the ground or upon low places where it will remain during the process of decomposition or into a slough, pond, lake, or other body of stagnant or standing water.

[Disposal of Bodies of Dead Animals. Reg. Bd. of H., July 25, 1913.]

118. No carcass of any dead animal shall be left unburied in the State of South Dakota, nor shall it be thrown into any lake, stream, pond, well, or any other body of water.

119. Any such carcass shall be buried by the owner so that it will be covered by at least 3 feet of earth.

120. Burial shall be made within 24 hours after death, and in all cases of death from a communicable disease the body shall be thoroughly enveloped in quicklime.

121. At all municipal dumping grounds where carcasses are disposed of provision must be made for their immediate burial.

122. In lieu of the foregoing the dead bodies of animals may be burned.

TENNESSEE.

[CODE, 1917.]

2185a. *Cemeteries not to be located upon watersheds furnishing water supplies.*—It shall hereafter be unlawful for any cemetery, graveyard, or burying place for the dead to be located, or for any dead body to be buried, upon any stream or watercourse, or the watershed draining upon any stream or watercourse, from which is taken the water supply to be used by the inhabitants of any city or town having a population of 36,000 and upwards, according to the Federal census of 1880, or any subsequent Federal census; and where such cemetery, graveyard, or burying place for the dead, or the burying of such dead body, shall be within 10 miles of the corporate limits of said city or town, and in such a place that the surface, storm, or drainage water from that place will flow into or commingle with the waters of said stream or watercourse above the intake point in said stream or watercourse from which is drawn the water supply for the inhabitants of said city or town.

2185a–1. *Same subject.*—It shall be unlawful for any cemetery, graveyard, or burying place for the dead to be located, or for any dead body to be buried upon any tributary or watershed draining upon any tributary, to said stream or watercourse described in the first section of this act,[1] where such cemetery, graveyard, or burying place for the dead, or the burying of such dead body, shall be within 10 miles of the corporate limits of said city or town, and where such tributary stream flows into the main stream or watercourse at a point above the intake point in such main stream or watercourse from which is drawn the water supply for the inhabitants of said city or town.

2185a–2. *Intent of act.*—The intent of this act[2] is to save from contamination and preserve the purity of the water supply to be used by the inhabitants of said city or town; and nothing in this act shall be construed to forbid the location of burying places for the dead, or the burying of dead bodies, within a nearer distance than 10 miles from the corporate limits of said city or town: *Provided,* That such cemetery or burying place for the dead shall not be located, or such body buried, on a stream or a tributary, or a watershed of a tributary or stream, in such a place or locality as will or may contaminate the waters of said stream or watercourse above the intake point of supply in said stream or watercourse, as set forth in the first section of this act.

2185a–3. *Penalties.*—Any person convicted of any of the offenses, or of aiding or abetting the commission of any of the offenses mentioned in this act, shall upon conviction thereof pay a fine in an amount not to exceed $250, and may be imprisoned in the county jail, at the discretion of the court, for a period of time not to exceed 90 days.

2498a–4. *Prohibiting injury to water supplies.*—It shall be a misdemeanor for any person * * * to willfully disturb, pollute, contaminate, or injure the water in the tanks, standpipes, or reservoirs of any such waterworks by bathing therein or by any other act or acts tending to injure the water, or to make it unpalatable, unwholesome, or unfit for domestic or manufacturing purposes, of any plant supplying water for domestic or manufacturing purposes, whether the same shall belong to a city or town government, or to a waterworks company, or to any person, firm, or corporation; and any person found guilty thereof, or anything prohibited hereby, shall pay a fine of not less than $5 nor more than $50, one-half of which shall go to the informer, and the other half to the public school fund.

2498a–5. *Prohibiting pollution water supplies.*—It shall be a misdemeanor for any person to willfully corrupt or to permit anything to run or fall into any

[1] Section 2185a above. [2] Sections 2185a–2185a–4.

stream from which water shall be taken for the purpose of supplying water to any water plant such as is referred to in section 1 of this act,[1] and any person violating this section shall be punished as provided in section 1 hereof.

2498a–6. *Inquisitorial powers of grand juries.*—The grand juries of this State shall have inquisitorial power of all offenses committed against this act and the same shall be given in charge to such juries by the judges of the several circuit courts of the State.

2957a–46. *Use of poison for taking fish prohibited.*—It shall be unlawful * * * for any person or persons within this State to capture, kill, or wound any fish in any of the streams, rivers, lakes, bayous, or ponds of this State by means of * * * poison, lime, fish berries * * *: *Provided*, That the taking of fishes from ponds or reservoirs wholly on private property * * * shall not be deemed to be within the inhibition of this section. Any person or persons violating any of the provisions of this section shall be guilty of a misdemeanor, and, upon conviction, shall be fined not less than $25 nor more than $100.

2957a–52. *Dumping sawdust wastage in streams.*—It shall be unlawful to dump the sawdust wastage from any mill, or other source, into the waters of any stream that is the known habitat of edible fishes. Any person violating this provision shall be guilty of a misdemeanor, and on conviction, shall be fined not less than $25 nor more than $50.

6496. *Misdemeanor to injure water or spring.*—It is declared to be a misdemeanor—

(4) To injure any spring, well, or water used by any worshipping assembly or belonging to another person.

6520. *Throwing dead body into any spring, etc.*—If any person place or throw the dead body of any animal in any spring, well, cistern, or running stream of water, he is guilty of a misdemeanor.

6751. *Polluting rivers, etc., a nuisance.*— * * * the corrupting or rendering unwholesome or impure the water of any river, stream, or pond are nuisances.[2]

6754. *Befouling water supplies.*—It shall be a high misdemeanor for any person or persons to prosecute or carry on any business, or to erect or construct any slaughterhouse, hide house, bone yard, tanyard, or soap factory, or to deposit any injurious matter, thing, or substance, or to do any other act or thing in such manner or at such a place as to injure or pollute the water of any stream from which water is taken by means of waterworks to supply any town or city in this State.

6755. *Penalties.*—Any person or persons violating the provisions of the above section shall, upon indictment and conviction, be fined at the discretion of the jury; and the court before whom the conviction is had shall order the abatement of such nuisance, and each day that any such nuisance is done or continued shall constitute an additional offense, and the person or persons so offending shall be liable to the water company, or other persons injured, for all damages resulting from such injury.

6771. *Putting dead body of person into stream.*—Any person who willfully and unnecessarily and in an improper manner indecently exposes, throws away, or abandons any human body, or the remains thereof, in any public place or in any river, stream, pond, or other place is guilty of a misdemeanor.

6869. *Polluting rivers, etc., a nuisance.*—It is a public nuisance—

(3) To corrupt or render unwholesome or impure the water of any river, stream, or pond to the injury or prejudice of others.[3]

---

[1] Section 2498a–4 above. [2] See sec. 6869 below. [3] See sec. 6751 above.

TEXAS.

[PENAL CODE, 1911.]

695. *Pollution of water supplies.*—If any person shall in any wise pollute or obstruct any watercourse, lake, pond, marsh, or common sewer, or continue such obstruction or pollution, so as to render the same unwholesome or offensive to the inhabitants of the county, city, town, or neighborhood thereabout, he shall be fined in a sum not exceeding $500.

907 (as amended by General Laws of 1913, chap. 135). *Catching of fish, green turtle or terrapin, etc., by means of poisons prohibited.*—The catching, taking or killing of fish, green turtle, or terrapin in any of the salt waters or fresh waters, lakes, or streams in the State by poison, lime * * * is hereby prohibited; and any person offending against this article shall be deemed guilty of a misdemeanor, and upon conviction shall be fined not less than $25 nor more than $200, and by confinement in the county jail not less than 30 nor more than 90 days.[1]

1077. *Poisoning water supplies.*—If any person * * * shall willfully poison or cause to be poisoned any spring, well, cistern, or reservoir of water with such intent [to kill or injure any other person], he shall be punished by imprisonment in the penitentiary not less than 2 nor more than 10 years.

[GENERAL LAWS OF 1911, CHAP. 110.]

SECTION 1. *Unlawful to poison fish.*—It shall be unlawful for any person to take, catch, kill, or destroy any fish within the fresh-water streams, lakes, bayous, ponds, or pools in this State * * * by means of poisoning, liming, ditching, draining, muddying * * *.[1]

SEC. 2. *Penalty.*—Any person who shall take, catch, kill, or destroy any fish within the fresh-water streams, lakes, bayous, ponds, or pools of this State * * * by poisoning or liming during any season of the year shall be deemed guilty of a misdemeanor and upon conviction he shall be fined in any sum not less than $100 nor more than $500, or by imprisonment in the county jail for a term of not less than 30 days and not more than 90 days, or by both such fine and imprisonment.[2]

[ACTS OF 1913, CHAP. 47, AS AMENDED BY ACTS OF 1915, CHAP. 23.]

SECTION 1. *Pollution of watercourses.*—It shall be unlawful for any person, firm, or corporation, private or municipal, to pollute any watercourse, or other public body of water, from which water is taken for the uses of farm, live stock, drinking, and domestic purposes, in the State of Texas, by the discharge, directly or indirectly, of any sewage or unclean water or unclean or polluting matter or thing therein, or in such proximity thereto as that it will probably reach and pollute the waters of such watercourse or other public body of water from which water is taken, for the uses of farm, live stock, drinking, and domestic purposes: *Provided, however,* That the provisions of this bill shall not affect any municipal corporation situated on tide water; that is to say, where the tide ebbs and flows in such watercourse. A violation of this provision shall be punished by a fine of not less than $100 and not more than $1,000.

[1] See chap. 110, General Laws of 1911, secs. 1 and 2.
[2] See sec. 907 of the Penal Code, above.

When the offense shall have been committed by a firm, partnership, or association, each member thereof who has knowledge of the commission of such offense shall be held guilty. When committed by a private corporation, the officers and members of the board of directors having knowledge of the commission of such offense shall each be deemed guilty; and when by a municipal corporation, the mayor and each member of the board of aldermen or commission having knowledge of the commission of such offense, as the case may be, shall be held guilty as representatives of the municipality; and each person so indicted as above shall be subject to the punishment provided hereinbefore: *Provided, however*, That the payment of the fine by one of the persons so named shall be a satisfaction of the penalty as against his associates for the offenses for which he may have been convicted: *Provided*, The provisions of this act shall not apply to any place or premises located without the limits of an incorporated town or city, nor to manufacturing plants whose affluents [sic] contain no organic matter that will putrify, or any poisonous compounds, or any bacteria dangerous to public health or destructive of the fish life of streams or other public bodies of water.

SEC. 2. *Writ of injunction to follow conviction.*—Upon the conviction of any person under section 1 of this act it shall be the duty of the court, or judge of the court, in which such conviction is had to issue a writ of injunction, enjoining and restraining the person or persons or corporation responsible for such pollution from a further continuance of such pollution; and for a violation of such injunction the said court and the judge thereof shall have the power of fine and imprisonment, as for contempt of court, within the limits prescribed by law in other cases: *Provided*, That this remedy by injunction and punishment for violation thereof shall be cumulative of the penalty fixed by section 1 of this act; and the assessment of a fine for contempt shall be no bar to a prosecution under section 1; neither shall a conviction and payment of fine under section 1 be a bar to contempt proceedings under this section.

SEC. 3. *Cities, sewage from which pollute watercourses, given three years to alter plants.*—Any city or town of this State with a population of more than 50,000 inhabitants which has already an established sewerage system dependent upon any watercourse or other public body of water from which water is taken for the uses of farm, live stock, drinking, and domestic purposes, or which discharges into any watercourse or public body of water from which water is taken for the uses of farm, live stock, drinking, and domestic purposes, shall have until Jan. 1, 1917, within which to make other provisions for such sewage. Cities and towns of less population than 50,000 inhabitants shall have until Jan. 1, 1917, within which to make other arrangements for the disposal of such sewage. Any person, firm, or corporation, private or municipal, coming under or affected by the terms of this bill, or any independent contractor having the disposal of the sewage of any city or town, shall have until Jan. 1, 1917, within which to make other arrangements for the disposal of such sewage, or other matter which may pollute the water, as defined in this bill.

SEC. 4. *State board of health to enforce this act.*—The Texas State Board of Health is authorized, and it is hereby made its duty, to enforce the provisions of this act; and to this end the governor shall appoint, by and with the consent of the senate, an inspector, to act under the direction of the said board of health and the State health officer, making such investigations, inspections, and reports, and performing such other duties in respect to the enforcement of this act as the said board of health officer may require.

UTAH.

[COMPILED LAWS, 1907.]

65. *Dead animals not to be deposited near spring or stream.*—No such animal [dead domestic animal] shall be left unburied within * * * 20 rods from any spring, running stream, or water ditch. * * *

66. *Penalty.*—Any person refusing or neglecting to comply with any of the requirements of this chapter [secs. 64–67] shall, upon conviction thereof before any justice of the peace having jurisdiction, be fined in any sum not exceeding $10, the expense of removing or burying said animal, and costs of suit.

67. *Owner liable for expense.*—If the owner or the person in charge of any such animal at the time of its death shall fail to remove or bury the same as in this chapter provided, any citizen may bury or remove such animal and collect pay therefor from the owner, if known, or from the county when the owner is unknown. * * *

206x15 (as amended by chap. 100, Laws of 1915). *City council to protect water supply from pollution.*—[The city council shall have power] to construct or authorize the construction of waterworks without their limits; and for the purpose of maintaining and protecting the same from injury and the water from pollution, their jurisdiction shall extend over the territory occupied by such works; and over all reservoirs, streams, canals, ditches, pipes, and drains used in and necessary for the construction, maintenance, and operation of the same, and over the stream or source from which the water is taken, for 10 miles above the point from which it is taken; and to enact all ordinances and regulation [sic] necessary to carry the power herein conferred into effect: *Provided, however,* That each city of the first class shall provide a highway in and through its corporate limits and so far as its jurisdiction extends, which shall not be closed to cattle, horses, sheep, or hogs, which are being driven through any such city or through any territory adjacent thereto, over which the said city has jurisdiction, but the city council of such city may enact ordinances placing under police regulations the manner of driving such cattle, sheep, horses, and hogs through such city or any territory adjacent thereto over which the said city has jurisdiction.

206x17 (as amended by chap. 100, Laws of 1915). *Council to control water courses.*—[The city council shall have power] to control the water and water courses leading to the city, and to regulate and control the watercourses and mill privileges within the city: *Provided,* That the control shall not be exercised to the injury of any rights already acquired by actual owners * * *.

302x13 (as amended by chap. 119, Laws of 1917). *Town trustees to protect water supply from pollution.*—[The board of trustees in each town shall have power] to lay out, construct, open, and keep in repair canals, water ditches, or water pipes to conduct water for artificial light and power purposes * * * for the purpose of protecting the water that is used for culinary and domestic uses from pollution, their jurisdiction shall extend over the stream or source from which the water is taken for 10 miles above the point from which it is taken from the natural stream * * *.

1098. *Rules and regulations to be made by State board of health.*—The board [State board of health] * * * shall have authority to make such rules and regulations not contrary to law as may be deemed necessary for the preservation of public health. * * *

1113x. *Nuisance defined.*—Whatever is dangerous to human life and whatever renders * * * water * * * impure or unwholesome are declared to be nuisances and to be illegal, and every person, either owner, agent, or

occupant, having aided in creating or contributing to the same, or who may support, continue, or retain any of them shall be deemed guilty of a misdemeanor.

1113x1. *Throwing offal into watercourses forbidden.*—No house refuse, offal, garbage, dead animals, decaying vegetable matter, or organic waste substance of any kind shall be thrown or allowed to remain * * * in any * * * watercourse, lake, pond, spring, or well.

1113x3. *Privies not to be located near springs, etc.*—No privy vault, cesspool, or reservoir into which a privy, water closet, stable, or sink is drained shall be established or permitted within 50 feet of any surface well, spring, or other source of water used for drinking or culinary purposes, without written permission from the board of health, based upon the advice of the medical health officer. * * *

113x4. *Pigpens not to be maintained within 100 feet of well or spring.*—No pigpen shall be built or maintained within 100 feet of any well or spring of water used for drinking purposes * * *.

1113x5. *Hog yards and piggeries not to be permitted within 100 feet of stream used for culinary purposes.*—Hog yards and piggeries will not be permitted within 100 feet of any natural stream, or watercourse used for culinary purposes, and the drainage of a piggery shall in no case be permitted to reach any natural stream until said drainage has been purified.

1288x5 (as amended by chap. 103, Laws of 1911). *Rights to unappropriated water.*—Rights to the use of the unappropriated water in the State may be acquired by appropriation, in the manner hereinafter provided, and not otherwise. The appropriation must be for some useful or beneficial purpose, and, as between appropriators, the one first in time shall be first in right * * *.[1]

3058. *When injunction may be granted.*—An injunction may be granted in the following cases:

1. When it appears by the complaint that the plaintiff is entitled to the relief demanded, and such relief, or any part thereof, consists in restraining the commission or continuance of the act complained of, either for a limited period or perpetually.

2. When it appears by the complaint or affidavit that the commission or continuance of some act during the litigation would produce great or irreparable injury to the plaintiff.[2]

3506. *Definition of nuisance.*—Anything which is injurious to health * * * is a nuisance, and the subject of an action. Such action may be brought by any person whose property is injuriously affected, or whose personal enjoyment is lessened by the nuisance; and by the judgment the nuisance may be enjoined or abated, as well as damages recovered.[3]

4065. *Penalty for misdemeanor when not prescribed.*—Except in cases where a different punishment is prescribed by law, every offense declared to be a misdemeanor is punishable by imprisonment in a county jail not exceeding six months, or by a fine in any sum less than $300, or by both. In all cases where a corporation is convicted of an offense for the commission of which a natural person would be punishable as for a misdemeanor, and there is no other punish-

[1] This section is given because it is cited in Cole *v.* Richards Irr. Co., 27 U. 205; 75 P. 376, and in Crane *v.* Winsor, 2 U. 248, in which it is held that a person is liable for any interference with appropriated water that impairs the quality thereof. It seems unnecessary to quote further from the law.

[2] Injunction may be granted to prevent the pollution of waters used for irrigation and domestic purposes. Crane *v.* Winsor, 2. U. 248. North Point C. I. Co. *v.* Utah & S. L. C. Co., 16 U. 246, 52 P. 168.

[3] The mixing of impure water with water used for irrigation and domestic purposes, which renders it unfit for such use, causes a nuisance. North Point C. I. Co. *v.* Utah & Salt Lake C. Co., 16 U. 246; 52 P. 168.

ment prescribed by law, such corporation is punishable by a fine not exceed $1,000.

4268. *Penalty for poisoning water supplies.*—* * * every person who fully poisons any spring, well, stream, or reservoir of water is punishable imprisonment in the State prison for a term not less than one nor more 10 years.

4274. *Befouling water.*—Any person who shall, either:

1. Construct or maintain any corral, sheep pen, stable, pigpen, chicken or other offensive yard or outhouse, where the waste or drainage therefrom flow directly into the waters of any stream, well, or spring of water used domestic purposes; or,

2. Deposit, pile, unload, or leave any manure heap, offensive rubbish, or carcass of any dead animal, where the waste or drainage therefrom will directly into the waters of any stream, well, or spring of water used for dom purposes; or,

3. Dip or wash sheep in any stream, or construct, maintain, or use any or dipping vat for dipping or washing sheep in such close proximity to stream used by the inhabitants of any city, town, or village for domestic poses, as to make the waters thereof impure or unwholesome; or,

4. Construct or maintain any corral, yard, or vat, to be used for the pose of shearing or dipping sheep within 12 miles of any city, town, or vil where the refuse or filth from the said corral or yard would naturally find way into any streams of water used by the inhabitants of any city, village town for domestic purposes; or,

5. Establish and maintain any corral, camp, or bedding place for the pur of herding, holding, or keeping any cattle, horses, sheep, or hogs within 7 m of any city, town, or village, where the refuse or filth from said corral, c or bedding place will naturally find its way into any stream of water used the inhabitants of any city, town, or village, for domestic purposes—shall guilty of a misdemeanor.

4275. *Public nuisance defined.*—A public nuisance is a crime against t order and economy of the State, and consists in unlawfully doing any act, omitting to perform any duty, which act or omission either—

1. Annoys, injures, or endangers the comfort, repose, health, or safety three or more persons; or

3. Unlawfully interferes with * * * any lake, stream, canal, basi * * *.[1]

4279. *Dead animals not to be placed in streams.*—Every person who puts the carcass of any dead animal, or the offal from any slaughter pen, corral, or butcher shop into any river, creek, pond * * * is guilty of a misdemeanor.

[LAWS, 1917, CHAP. 79.]

SEC. 9. *Pollution of streams by sawdust.*—* * * It shall be a misdemeanor for any person, corporation, or company owning any mill, factory, or reduction works in this State to cause or permit any refuse matter from said mills, factory, or reduction works to be washed, dumped, or placed in any of the streams or waters of this State, or to place such refuse matter from said mill, factory, or reduction works in such close proximity to any of the streams that the same might be washed into said streams by rain. Any person or persons

[1] The befouling of waters of a canal, from which a number of persons obtained water for irrigation, domestic, and other purposes, so that it is unfit for use, creates a public nuisance, and the right to maintain it can not be gained by prescription. North Point C. I. Co. *v.* Utah & L. C. Co., 16 U. 246; 52 P. 168. Crane *v.* Winsor, 2 U. 248.

iolating the provisions of this section shall be guilty of a misdemeanor and ned not less than $100 for such violation, and each day during which such iolation continues shall constitute a separate offense.

SEC. 20. *Poison to be seized.*—All * * * lime, poison, drugs * * * for ie unlawful taking of fish or game of any kind found in the possession of ny person who may be detected in unlawfully taking fish from any of the aters of the State * * * shall be seized by the officer making the arrest, nd if it appears from evidence before the magistrate trying the case that he * * * lime, poison, drugs * * * were used for the unlawful taking f fish or game, the same shall be confiscated and sold at public auction by the tate commissioner and the proceeds therefrom turned into the fish and game und.

[CAMPS—SANITARY REGULATIONS. REG. BD. OF H., SEPT. 8, 1915.]

REGULATION 1. *Pollution of waters prohibited.*—All persons living in the open r in camps, tents, or other temporary shelters shall exercise every proper and easonable precaution to dispose of their wastes, so that springs, lakes, reservoirs, streams, and other watercourses shall not be polluted.

REG. 2. *Notice of labor or construction camp to be occupied by five or more persons to be given State board of health.*—Every railroad or other corporation, contractor, lumberman, or other person in Utah who shall establish, construct, or maintain any labor or construction camp to be occupied by five or more persons, and the person in charge of any temporary living quarters on wheels or otherwise that shall be provided for five or more workmen, shall at once notify the State board of health by telephone, telegraph, or letter, of the presence and location of such quarters or camp.

REG. 9. *No building, tent, or car in any camp to be nearer than 50 feet of water's edge of public water supply.*—In every camp or temporary quarters the nearest part of any building, tent, car, or shed shall be at least 50 feet in a horizontal direction from the water's edge of any stream, lake, or reservoir.

REG. 10. *Suitable privy or other toilet facilities to be provided and used.*—For every camp there shall be provided convenient and suitable privy or other toilet facilities approved by the State board of health, which the occupants of the camp shall be required to use instead of polluting the ground.

REG. 11. *Construction of privies more than 200 feet from the water's edge.*—If such privy be more than 200 feet from the water's edge of any spring, stream, lake, or reservoir forming part of a public or private water supply, it shall consist of a pit at least 2 feet deep, with suitable shelter over the same. No such pit shall be filled with excreta to nearer than 1 foot from the surface of the ground, and the excreta in the pit shall always be covered with earth or ashes. If the camp is to be occupied for more than six days between May 1 and November 1, the shelter and pit shall be inclosed in fly netting.

REG. 12. *Construction and care of privies located between 50 and 200 feet from the water's edge.*—If such privy be between 50 and 200 feet from the waters of a spring, stream, lake, or reservoir forming part of a public or private water supply, there shall be no pit, but the excreta shall be received in a water-tight tub or bucket and periodically, as often as may be found necessary, shall be taken away and disposed of. Such privy shall be properly screened against flies and kept in a clean and sanitary condition; the pails or buckets shall not be allowed to fill so that they overflow or spill in carrying, and the construction of the privy shall be such that the convenient removal and replacement of the tubs or buckets is facilitated.

REG. 13. *Disposal of wastes from privies.*—The pails, tubs, or buckets used in privies located between 50 and 200 feet from the water's edge, as referred to in regulation 12, shall, when not more than three-quarters filled, be removed from the privy and carried at least 200 feet from the water's edge and the contents there either burned or buried in a trench at least 2 feet deep, so that when buried there shall be at least 1 foot of earth cover. The pails, tubs, or buckets immediately after being emptied shall be rinsed out with a suitable disinfectant as particularly prescribed for such purposes by the special rules and regulations of the State board of health, and the rinsing fluid shall also be emptied into the trench.

REG. 14. *Garbage to be disposed of in suitable manner.*—All garbage, kitchen wastes, and other rubbish in camps shall be deposited in suitable covered receptacles, which shall be emptied daily or oftener if necessary and the contents burned, buried, or otherwise disposed of in such a way as not to be or become offensive or insanitary.

REG. 15. *Water rules to be observed.*—Whenever a camp is established on the banks of a spring, lake, reservoir, stream, or other watercourse which is a source of water supply, no bathing or washing by the occupants of said camp shall be allowed in said springs, lakes, reservoirs, streams, or other watercourses.

REG. 16. *Location and drainage of stables regulated.*—No stable or other shelter for animals shall be maintained within 100 feet of any living quarters in a camp nor within 150 feet of any kitchen or messroom therein. No drainage from such stable or shelter shall be permitted to empty directly into any spring, lake, reservoir, stream, or other watercourse forming a part of a public or private water supply.

VERMONT.

[PUBLIC STATUTES, 1906.]

5419. *Promulgation and enforcement of rules and regulations by State board of health.*—Said board [State board of health] may promulgate and enforce rules and regulations relative to the preservation of the public health in contagious and epidemic diseases and the causes, development, spread, and prevention of disease. * * *

5420. *Failure to comply with regulations of board; penalty.*—A person who fails to comply with a rule or regulation of said board, after being notified in writing by the secretary of the State or local board of health, shall be fined not more than $100 nor less than $10, with costs of prosecution.

5462. *Penalty for polluting streams with dead animals.*—A person who puts or causes to be put a dead animal or animal substance into or upon the bank of a lake, pond, running stream, or spring of water so that it is drawn or washed into the same and suffers it to remain therein for a period of 48 hours shall be fined not more than $50 nor less than $5, with costs of prosecution.

5495. *Supervision of sources of water and ice supply.*—The State board of health shall have the general oversight and care of waters, streams, and ponds used by a town, village, public institution, or a water or ice company as a source of water or ice supply, and of springs, streams, and watercourses tributary thereto. Said board shall, upon request, be provided with maps, plans, and documents suitable for such purposes by and at the expense of such town, village, public institution, or water or ice company, and said board shall keep records of its transactions relative thereto.

5496. *Use of water and ice prohibited; powers of court of chancery.*—Said board may prohibit the use of water or ice from any source, when, in its opinion, the same is so contaminated, unwholesome, or impure that the use thereof endangers the public health. The court of chancery may upon application therefor by said board, enforce any order, rule, or regulation which said board may make under and by virtue of this section.

5497. *Examination of waters; rules and regulations.*—Said board may cause examinations of such waters to be made to ascertain their purity and fitness for domestic use, or their liability to impair the interests of the public or of persons lawfully using them, or to imperil the public health. Said board may make rules and regulations to prevent the pollution and to secure the sanitary protection of such waters.

5498. *Publication of orders, rules, etc.*—The publication of an order, rule, or regulation made by said board under the provisions of this chapter, in a newspaper published in the town or village in which such order, rule, or regulation is to take effect, or, if no newspaper is published in such town or village, the posting of a copy of such order, rule, or regulation in three public places in such town or village shall be legal notice to all persons; and an affidavit of such publication or posting by the person causing such notice to be published or posted, filed, and recorded with a copy of the notice in the office of the clerk of such town or village shall be admitted as evidence of the time at which and the place and manner in which the notice was given.

5499. *Report; recommendations; violations; expert assistants.*—Said board shall include in its biennial report its doings for the preceding biennial term, and shall recommend measures for the prevention of the pollution of such waters and for the removal of polluting substances, in order to protect the public health and develop and protect the rights of the State in such waters, and shall recommend any legislation or plans for systems of main sewers necessary for the preservation of the public health and for the purification and prevention of pollution of ponds, streams, and waters. Said board shall notify the State's attorney of the county wherein any violation of a provision of this chapter occurs; and said board may, when necessary, employ expert assistants.

5500. *Advice as to proposed water or sewer systems; "drainage" and "sewage" defined.*—Towns, villages, or persons shall submit to said board for its advice their proposed systems of public water supply or for the disposal of drainage or sewage. Said board shall consult with and advise municipal authorities or persons having or about to have systems of public water supply, drainage, or sewage as to the most appropriate sources of water supply, and as to the best methods of assuring its purity and of disposing of their drainage or sewage, with reference to the existing and future needs of other towns which may be affected thereby. Said board shall consult with and advise persons engaged or intending to engage in manufacturing or other business whose drainage or sewage may tend to pollute water or a source of water or ice supply as to the best method of preventing such pollution, and it may conduct experiments to determine the best method of purification or disposal of drainage or sewage. A person shall not be required to pay the expense of such consultation, advice, or experiments. The word "drainage," as used in this section, shall mean rainfall, surface and subsoil water, and "sewage," domestic and manufacturing filth and refuse.

5501. *Complaints; hearings; orders.*—Upon petition to said board by the mayor of a city, the selectmen of a town, the trustees of a village, the managing board or officer of a public institution, or by a board of water commissioners, or the president of a water or ice company, stating that manure, excrement,

garbage or other matter is polluting or tending to pollute the water of a stream, pond, spring, or water course used by such city, town, village, institution, or company as a source of water or ice supply, said board shall appoint a time and place for hearing within the county where the nuisance or pollution is alleged to exist, and, after notice thereof to parties interested and a hearing, if, in its judgment, the public health so requires, shall, by an order served upon the party or company causing or permitting such pollution, prohibit the deposit, keeping or discharge of such cause of pollution, and shall order him to desist therefrom and to remove such cause of pollution.

5502. *Cultivation of soil; use of structures.*—Said board shall not prohibit the cultivation or use of soil in the ordinary methods of agriculture if no human excrement is used therefor. Said board shall not, upon complaint made by the board of water commissioners of a city, town, village, or by a water or ice company, prohibit the use of a structure which was in existence prior to December 12, 1902, unless such board of water commissioners or company files with the State board of health a vote of its city council, selectmen, trustees, or company, respectively, that such city, town, village, or company will, at its own expense, make such change in such structure or its location as said board shall deem expedient. Such vote shall be binding on such city, town, village, or company.

5503. *Damages; appeals.*—Damages caused by such change shall be paid by such city, town, village, or company; and, if the parties can not agree thereon, such city, town, village, or company shall tender to the parties sustaining damages such a sum of money as, in their judgment, is a reasonable compensation for the damages sustained. A person aggrieved by an order under the provisions of this or the two preceding sections, or with the sum so tendered as damages, may appeal therefrom in the manner provided in sections 3835 to 3838,[1] inclusive. But the notice provided for therein shall be served on the petitioners in fact under the second preceding section and also upon the State board of health. If the appeal be only from the compensation for damages the order of said board shall be complied with during the pendency of such appeal, unless otherwise authorized by said board.

5504. *Powers of court of chancery.*—The court of chancery shall have jurisdiction and power, upon application thereto by the State board of health or a party interested, to enforce its orders or the orders, rules, and regulations of said board, and to restrain the use or occupation of the premises or such portion thereof as said board may specify, on which such material is deposited or kept or such other cause of pollution exists, until the orders, rules, and regulations of said board are complied with.

5505. *Entrance into buildings, structures, etc., by board.*—Said board or an agent thereof may enter any building, structure, or premises for the purpose of ascertaining whether sources of pollution or danger to the water supply exist therein, and whether the rules, regulations, and orders of said board are obeyed.

5506. *Violation of rules, regulations, and orders.*—A person who violates a rule, regulation, or order made under the provisions of this chapter shall be imprisoned not more than one year or fined not more than $500, or both.

5507. *Deposit of polluting matter prohibited.*—No sewage, drainage, refuse, or polluting matter of such kind and amount as either by itself or in connection with other matter will corrupt or impair the quality of the water of a pond or stream used as a source of ice or water supply by a town, village, public institution, water or ice company, or person for domestic use, or render it injurious to health, shall be discharged into any such stream or pond or upon their banks.

[1] Not given in this compilation.

5508. *Same; penalty; proceedings.*—A person who willfully deposits excrement or foul or decaying matter in water which is used for the purpose of domestic water or ice supply, or on the shores thereof within 5 rods of the water, shall be imprisoned not more than 30 days or fined not more than $50. A constable or police officer of a town or village in which such water is wholly or partially situated, acting within the limits of his town or village, an executive officer or agent of a water board, board of water commissioners, public institution, or water or ice company furnishing water or ice for domestic purposes, acting upon the premises of said board, institution, or company and not more than 5 rods from the water, may, without a warrant, arrest a person found in the act of violating a provision of this section and detain him until complaint may be made against him therefor. The provisions of this section shall not apply to the sewage of a town, village, or public institution, or prevent the enrichment of land for agriculture by the owner or occupant thereof.

5701. *Poisoning wells, etc.; penalty.*—A person who * * * willfully poisons a spring, well, or reservoir of water, with a like intent [that of killing or injuring another person], shall be imprisoned in the State prison not more than 20 years.

[No. 171, Acts of 1908.]

Section. 1. *Pollution of certain waters prohibited.*—No person shall discharge sewerage [sic] or other polluted matter into the waters of any pond or lake having an area of 1,000 acres or more lying wholly within the State. A person who violates a provision of this act shall be fined not more than $200 nor less than $20. Justices shall have concurrent jurisdiction with the county court of offenses under this act.

[No. 211, Acts of 1908 (as Amended by No. 266, Acts of 1912).]

Section 1. *Sawdust not to be deposited in Lamoille River, etc.*—An owner or operator of a mill, who, by himself or agents, deposits or suffers to be deposited any sawdust, shavings, or mill refuse in the waters of the Lamoille River or in its tributaries above Ithiel Falls in the town of Johnson, shall be fined not less than $20 nor more than $100 for each offense.

[No. 232, Acts of 1912.]

Sec. 37. *Placing poisons in water prohibited.*—No person shall place in any of the waters of this State, lime, creosote, cocculus indicus, or other drug or poison destructive to fish.

Sec. 40. *Penalty.*—A person who violates a provision of this part [Part IV of the act, entitled "Fish"] is guilty of a misdemeanor and shall be fined as follows: For each violation * * * of section 37, not more than $20 nor less than $10 * * *.

[No. 232, Acts of 1912.]

Section 1. *Edgings and slabs from mills not to be deposited in streams.*—The owner or operator of a mill who by himself or his agents deposits or suffers to be deposited any edgings or slabs in the waters of any stream in the State shall be fined not more than $100 nor less than $20 for each offense.

Sec. 2. *Power mills hereafter to be erected not to deposit sawdust, etc., in streams.*—The owner or operator of a water, steam, gasolene or electrical power

mill which shall hereafter be erected, constructed, or set up, who by himself or his agents deposits or suffers to be deposited any sawdust, shavings, bark, edgings, or mill refuse in the waters of any stream in the State shall be fined not more than $100 nor less than $20 for each offense.

SEC. 3. *Does not remove right to recovery of damages.*—This act shall not by implication or otherwise, take away or repeal any rights or remedies or any existing law, giving a person the right of recovery for or the protection against damages to his property or property rights by reason of sawdust, shavings, or other refuse being put into or negligently allowed to run into any stream of water, by another.

[No. 267, ACTS OF 1912.]

SECTION 1. *Sawdust, etc., not to be deposited in waters of Peter Brook.*—A person who by himself or his agents knowingly deposits or causes to be deposited any sawdust, shavings, or mill refuse in the waters of Peter Brook, so-called, leading from the mountain in the town of Glastenbury to the Battenkill River, shall be fined not more than $100 nor less than $25, for each offense.

[No. 268, ACTS OF 1912.]

SECTION 1. *Sewage not to be discharged in Ryder Brook.*—No person shall deposit, or cause to be deposited, any sewage in Ryder Brook, so-called, in the town of Morristown or in any of the tributaries of said brook above the dam authorized by vote of the village of Morrisville, September 17, 1912, and now being constructed near the mouth of said brook.

SEC. 2. *Penalty.*—A person who violates a provision of this act shall be fined not more than $50 or be imprisoned not more than three months, or both, for each offense.

[No. 269, ACTS OF 1912.]

SECTION 1. *Sawdust not to be deposited in brook leading to Sabin Pond.*—A person who, by himself, or agent, knowingly deposits or suffers to be deposited any sawdust, shavings, or mill refuse, in the brook leading from Valley Lake to Sabin Pond, shall be fined not more than $100 nor less than $25 for each offense.

[No. 270, ACTS OF 1912.[1]]

SECTION 1. *Sawdust not to be deposited in Williams River.*—A person who, by himself, servant, or agent, deposits sawdust, shavings, or mill refuse in the waters of the Williams River or the tributaries thereof shall be fined not more than $100 nor less than $25 for each offense.

[No. 238, ACTS OF 1915.]

SECTION 1. *Sewage not to be discharged into Lake Eden.*—No person shall deposit, or cause to be deposited any sewage in Lake Eden, so-called, in the town of Eden, or in any of the tributaries of said lake.

SEC. 2. *Penalty.*—A person who violates a provision of this act shall be fined not more than $50 or be imprisoned not more than three months, or both, for each offense.

[1] This act amends No. 180 of the Acts of 1890. Omitted from Public Statutes.

VIRGINIA.

[CODE, 1904; SUPPLEMENT, 1910; SUPPLEMENT, 1916.[1]]

1038. *City councils to prevent pollution of water supplies.*—* * * The uncil of every city and town shall have power * * * to prevent the pollu-on of the water and injuries to waterworks, for which purpose their jurisdic-on shall extend to 5 miles above the same * * *. (Supplement, 1910.)

2002. *Burial of dead from vessels.*—When any person dies on board of any ssel in this State, the master thereof shall cause the body to be buried above gh-water mark, and at least 4 feet deep. If he fail to do so, he shall forfeit 50. (Code, 1904.)

2087b. *Poisoning of fish prohibited.*—It shall not be lawful to use fish berries, ne, * * * for the destruction of fish in any of the waters in this State. ny person violating this act shall on conviction thereof be fined $30 for each fense, one-half to be paid to the informer, and shall be imprisoned in jail until e fine is paid, but not exceeding 30 days. (Code, 1904.)

2108. *Poisoning fish and depositing noxious substances in watercourses prohibited.* 1. It shall be unlawful—

* * * * * * *

Fourth. To use fish berries; lime * * * for the destruction of fish, or owingly or willfully to cast any noxious substance or matter into any water-urse of this State above tidewater, by which fish therein may be destroyed, to place or to allow to pass into the waters of the James or Appomattox ivers, or any of their tributaries, any lime, gas tar, or refuse of gas works, jurious to fish. (Supplement, 1916.)[2]

2109. *Penalty for violating preceding section.*—Any person violating any of e provisions of the preceding section shall on conviction thereof be fined r each offense $20 and be imprisoned in jail until the fine is paid, but not :ceeding 30 days and forfeit all boats, * * * or other contrivances em-oyed by him in such violation * * * (Code, 1904).

3813. *Casting dead animals, bait, etc., into watercourses above tidewater; w punished.*—If any person knowingly or willfully cast any dead animal, or ıy other noxious substance or matter, or what is commonly known as bait, to any watercourse of the State, above tidewater, by which the health of any ırson along said watercourse is affected, or the water is rendered impure or fensive, he shall be fined not less than $10 nor more than $50. (Code, 1904.)

3813a. *To prevent the pollution of potable water used for the supply of cities id towns.*—It shall be unlawful, except as hereinafter provided, for any per-n to defile or render impure, turbid or offensive the water used for the sup-y of any city or town of this State, or the sources or streams used for fur-shing such supply, or to endanger the purity thereof by the following means, any of them, to wit: By washing or bathing therein, or by casting into any ıring, well, pond, lake or reservoir from which such supply is drawn, or into ıy stream so used, or the tributary thereof, above the point where such supply taken out of such stream, or is impounded for the purposes of such supply, into any canal, aqueduct, or other channel or receptacle for water connected ith any works for furnishing a public water supply, any offal, dead fish, or ırcass of any animal, or any human or animal filth or other foul or waste

[1] Volume from which law is taken is indicated at the end of each section.

[2] This subsection appeared in this form in the Code of 1904, and for that reason 2087b the Code has been included in this compilation.

animal matter, or any waste vegetable or mineral substance, or the refuse of any mine, manufactory, or manufacturing process, or by discharging or permitting to flow into any such source, spring, well, reservoir, pond, stream, or the tributary thereof, canal, aqueduct, or other receptacle for water, the contents of any sewer, privy, stable, or barnyard, or the impure drainage of any mine, any crude or refined petroleum, chemicals, or any foul, noxious, or offensive drainage whatsoever, or by constructing or maintaining any privy vault or cesspool, or by storing manure or other soluble fertilizer of an offensive character, or by disposing of the carcass of any animal, or any foul, noxious or putrescible substance, whether solid or fluid, and whether the same be buried or not, within 200 feet of any watercourse, canal, pond, or lake aforesaid, which is liable to contamination by the washing thereof or percolation therefrom: *Provided*, That nothing in this act contained shall be construed to authorize the pollution of any of the waters in this State in any manner now contrary to law: *And provided further*, That this act shall not apply to streams the drainage area of which above the point where the water thereof is withdrawn for the supply of any city or town or is impounded for the purposes of such supply shall exceed 50 square miles. That any person knowingly or willfully violating the terms of this act shall be deemed guilty of a misdemeanor, and shall be punished for each offense by a fine not exceeding $100, or by imprisonment not exceeding 30 days, or by both, at the discretion of the court: *And provided further*, That nothing herein contained shall be so construed as to prevent the washing of ore or minerals in any of the streams or waters of the Commonwealth other than such as may be used for the water supply of any city or town. (Code, 1904.)

3813b. *To prevent the pollution of drinking water.*—Any person or persons who shall knowingly and willfully throw or cause to be thrown into any reservoir or other receptacle of drinking water, or spring or stream of running water ordinarily used for the supply of drinking water or domestic purposes of any person or family, town or city in this Commonwealth, the dead body of any animal, or shall drown and leave, or cause to be drowned and left any animal therein, shall be guilty of a misdemeanor, and, upon conviction thereof, shall be fined not exceeding $100, or imprisoned not exceeding six months, or both, at the discretion of the court in which such conviction is made. (Code, 1904.)

3902. *Misdemeanors for which no penalty is provided.*—A misdemeanor for which no punishment is prescribed by statute shall be punished by fine or confinement in jail, or both, in the discretion of the jury, or of the court trying the case without a jury.

[ACTS OF 1910,[1] CHAP. 179.]

SEC. 1. *State board of health to promulgate and enforce rules and regulations.*—The State board of health shall have the power to make, adopt, promulgate, and enforce reasonable rules and regulations from time to time * * * to regulate the method of disposition of garbage or sewage and any other refuse matter in or near any incorporated town, city, or unincorporated town or village of this State * * *.

SEC. 2. *Penalty for violation of rules and regulations.*—Any person who shall violate, disobey, refuse, omit, or neglect to comply with any rule of said State board of health, made by it in pursuance of this act, shall be guilty of a misdemeanor, and, upon conviction thereof, shall be punished in the manner provided by law. * * *

[1] In the Supplements of 1910 and 1916, sections not amendatory to the Code of 1904 are not given serial numbers, but remain under the separate acts.

[Acts of 1916, Chap. 46.]

Section 1. *Polluted areas of shellfish grounds to be marked, etc.*—For the purpose of protecting the shellfish industry of the State and preventing the sale of polluted, deleterious, or contaminated shellfish, the dairy and food commissioner is hereby directed to cause to be made, from time to time, examinations or analyses of the oyster and clam grounds located in the State and the shellfish intended for food purposes found thereon; and the said commissioner shall also cause examinations to be made of the waters flowing on and over said grounds; and when the said commissioner is satisfied, as a result of such examination or analysis or the surroundings, that such beds or waters or shellfish are polluted or contaminated, he shall, in collaboration with the commissioner of fisheries of the State, cause the limits or boundaries of such polluted or contaminated areas to be properly marked to indicate that the designated area is polluted or contaminated.

Sec. 2. *Unlawful to take oysters from polluted areas.*—When such polluted area or areas or waters have been determined and marked as hereinbefore provided, it shall be unlawful for any person or persons, firm, or corporation to take shellfish from such waters or areas for any purpose whatsoever except as hereinafter provided.

Sec. 3. *Removal from private polluted waters to unpolluted waters.*—When shellfish are found to be located on polluted areas or in contaminated waters on beds belonging to private parties under lease or deed, and it is desired to remove said shellfish so located to areas and waters free from pollution or contamination, the said shellfish may be removed for the aforesaid purpose only, provided the person or persons desiring to remove such shellfish shall first secure a permit for such removal from the commissioner of fisheries; and the said commissioner of fisheries is hereby authorized to grant, in his discretion, and under such rules and regulations as may be prescribed by him, permits for the removal of shellfish to unpolluted areas or uncontaminated waters: *Provided further*, That when shellfish shall have been so removed by permit, as hereinbefore provided, from privately owned polluted areas to areas free from pollution, it shall be unlawful to remove such shellfish again, unless they have remained on the unpolluted area at least seven days.

Sec. 3-a. *Removal from public polluted waters to unpolluted waters.*—When shellfish are found to be located on polluted areas or in contaminated waters, on beds belonging to the State (public grounds), the said shellfish may be removed by persons holding licenses to take oysters with ordinary tongs only from the said public ground, but only during the period from May 1 to August 15 of each year, and only for the purpose of transferring the said shellfish to areas and waters free from pollution or contamination: *Provided further*, That when shellfish shall have been so removed from polluted areas to areas free from pollution, it shall be unlawful to remove such shellfish again, unless they have remained on the unpolluted areas at least seven days.

Sec. 3-b. *Having polluted oysters in possession.*—It shall be deemed to be and shall be a violation of the provisions of this act for any person or persons so have in their possession, to store, to sell, or offer for sale shellfish which have been unlawfully removed from polluted or contaminated beds or waters contrary to the provisions of this act.

Sec. 4. *Oyster inspectors.*—For the purpose of carrying out the provisions of this act, the dairy and food commissioner and the commissioner of fisheries, and such agents or assistants of either of the said commissioners as are now or may hereafter be duly appointed, may enter on any premises located in the State, or on any boat, vessel, or barge or other conveyances, car,

wharf, shucking or packing house, or store, or stall, and if it appears that the provisions of this act have been violated, may, with or without a warrant, arrest any person or persons who have been or who are believed to have been in charge of such shellfish, or who may have such shellfish in their charge or possession in violation of the provisions of this act, and may seize in the name of the State of Virginia and take possession of any shellfish believed to be in violation of this act; and may seize and take possession of any vessel, boat, craft, or other thing used in violation of any of the provisions of this act, together with the cargo of such vessel, boat, or craft; and any vessel, boat, craft, or other thing, together with the cargo so seized, may be held by the official making the seizure or the official in whose district the same was seized, until the accused has paid the penalty of his offense, if upon trial he is found guilty, or has upon trial been acquitted, as the case may be. Any person or persons impeding, hindering, or interfering with the said commissioners, their agents, or assistants, or persons appointed by either of the said commissioners in the discharge of their duties in carrying out the provisions of this act, shall be guilty of a violation of the provisions of this act. Any person or persons, firm, or corporation who shall violate any of the provisions of this act shall be guilty of a misdemeanor, and upon conviction shall be fined not less than $25 for the first offense, and for any subsequent offense not less than $50, or may be punished by imprisonment not exceeding one year, or by both fine and imprisonment, in the discretion of the court, and such fines shall be paid into the treasury of the State through the oyster officials as in the case of all fines imposed and collected for violations of the oyster laws; and, in addition to the penalties herein provided, the shellfish taken from areas and waters contrary to the provisions of this act shall be forfeited to the State: *Provided, however*, That when an oyster inspector is directly instrumental in apprehending and bringing to trial an offender, against whom a fine is imposed and collected under this act, one-fourth of the fine shall go to the said inspector and the remaining three-fourths shall be paid to the auditor of public accounts, and credited as are all other fines imposed for violation of the oyster laws.

SEC. 5. *Penalty.*—The person liable for any fine for violation of this act may pay the officer directly instrumental in apprehending such person such sum as may be agreed upon between such person and officer and all costs; and thereupon such person shall be discharged from all legal proceedings that may be instituted against him for such offense: *Provided*, That the amount so agreed upon be not less than the minimum fine imposed for such offense, any such agreement to be in the nature of a compromise, and not to be used as evidence in any proceeding for such violation.

SEC. 6. *Enforcement.*—The dairy and food commissioner and the commissioner of fisheries of the State are hereby charged with the enforcement of the provisions of this act; and for the purpose of carrying out the provisions of this act, the said dairy and food commissioner and the said commissioner of fisheries are hereby authorized to make uniform rules and regulations in accordance with the provisions of this act; and it shall be the duty of every Commonwealth's attorney to whom the dairy and food commissioner or the commissioner of fisheries shall report any violation of this act to cause the proceedings to be commenced and prosecuted without delay for the fines and penalties in such cases prescribed.

[ACTS OF 1916, CHAP. 360.]

SECTION 1. *Definition of "waterworks."*—The term waterworks," whenever used in this act, shall be construed to mean and include all structures and appliances used in connection with the collection, storage, purification, and

treatment of water for drinking or domestic use and the distribution thereof to the public or more than 25 individuals, except only the piping and fixtures inside the buildings where such water is delivered. The term "water supply," whenever used in this act, shall be construed to mean and include water that shall have been taken into waterworks as hereinbefore defined from all streams, springs, lakes, and other bodies of surface water, natural or impounded, and the tributaries thereto, and all impounded ground water: *Provided*, That nothing in this act shall be held to apply to any waters above the point of intake of such waterworks.

SEC. 2. *State board of health to have control of water supplies.*—The State board of health shall have general supervision and control, in accordance with the provisions of this act, over all water supplies and waterworks in the State in so far as the sanitary and physical quality of waters furnished may affect the public health or comfort.

SEC. 3. *Examination of water supplies.*—Said board may cause examination of such water supplies to be made to ascertain their purity and fitness for drinking or domestic use or their liability to impair the public health.

SEC. 4. *State board shall advise local authorities.*—Said board shall, when requested, consult with and advise the authorities of cities and towns and persons having, or intending to have, waterworks installed as to the most appropriate source of water supply and the best method of assuring its purity without any expense to such authorities or persons; but said board shall not prepare plans, specifications, or detailed estimates for any proposed improvement.

SEC. 5. *Permit required for construction or extension of waterworks.*—No individual, firm, institution, corporation, or municipal corporation shall supply water for drinking or domestic purposes to the public within the State from or by means of any waterworks that shall hereafter be constructed or extended either in whole or in part, without a written permit from the State board of health for the supplying of such water; except that this provision shall not apply to the extension of water pipes for the distribution of water.

The application for such a permit shall be accompanied by a certified copy of the maps, plans, and specifications for the construction of such waterworks or extensions, and a description of the source or sources from which it is proposed to derive the supply and the manner of storage, purification, or treatment proposed for the supply previous to its delivery to consumers; and no other or additional source of supply shall subsequently be used for any such waterworks, nor any change in the manner of storage, purification, or treatment of the supply be made without an additional permit to be obtained in a similar manner from the State board of health. Whenever application shall be made to the State board of health for a permit under the provisions of this section it shall be the duty of said board to examine the application without delay, and as soon as practicable thereafter to issue said permit if, in its judgment the proposed supply appears not to be prejudicial to the public health or to make an order stating the conditions under which said permit will be granted.

SEC. 6. *Persons in charge of waterworks to furnish information to State board.*—Whenever an investigation of any water supply or waterworks within the boundaries of the State is undertaken by the State board of health to ascertain the purity or fitness of the water furnished to the public for drinking or domestic purposes, it shall be the duty of the individual, firm, institution, corporation, or municipal corporation having in charge the water supply or waterworks under investigation to furnish, on demand, to the State board of health, or the authorized agent of said board such information rela-

tive to the source or sources from which the said supply is derived, and the manner of storage, purification, or treatment of the water before its delivery to the consumers as may be necessary or desirable for the determination of its sanitary or physical quality. In making said investigation authorized agents of said board shall be allowed to enter any premises or buildings constituting a part of a water supply or waterworks for the purpose of inspecting same and ascertaining whether orders as provided for under this act are obeyed.

SEC. 7. *State board to order changes in plants where conditions menace health.*—When, upon investigation, the State board of health finds that a water supply furnished to the public for drinking or domestic purposes is a menace to health, said board is hereby given authority to make an order requiring such changes in the source or sources of said water supply or such alterations or extensions in the waterworks as said board may deem necessary. Said board shall name in its order such date for the completion of the works as said board may deem reasonable and proper, and it shall be the duty of the individual, firm, institution, corporation, or municipal corporation having in charge such water supply or waterworks to fully comply with said order within the time prescribed. As soon as said order of the State board of health, or the modified form of the order of the court, as hereinafter provided for, shall have been shown, upon investigation, to have been complied with fully, said board shall issue a written permit to the individual, firm, institution, corporation, or municipal corporation to furnish water to the public for drinking or domestic purposes.

SEC. 8. *Permits are revocable.*—Every permit issued by the State board of health under this act shall be revocable at any time it is shown by investigation that the waterworks can no longer be depended upon to furnish a water safe for drinking or domestic use, or that the capacity of said waterworks is inadequate for the purpose of furnishing water safe for drinking or domestic use, provided that a written notice is sent by said board to the individual, firm, institution, corporation, or municipal corporation in charge, together with an order requiring such changes in the water supply or waterworks as in its judgment may be necessary to safeguard the public health. Any permit issued by the State board of health may be specified to run a certain definite period, and said permit shall become inoperative at the expiration of the period of time without notice to that effect having been given by the State board of health.

SEC. 9. *Board to grant hearings.*—Whenever the board shall issue an order to an individual, firm, institution, or corporation under the provisions of this act said board shall appoint a time and place within the county, city, or town where such waterworks exist for a hearing on the subject, said hearing to be not less than two nor more than six months from the entry of such order. At such hearing the State board of health shall attend in person or shall deputize a committee of said board to attend or shall authorize the State health commissioner to act for and in the name of said board touching said hearing. At any such hearing all persons interested may appear and be heard and may present the testimony of expert and other witnesses, and said board may hear witnesses called upon its own motion. The State board of health shall have power to issue, in the name of the board, subpœnas for the attendance of witnesses and the production of books, papers, and maps relative to the sources of the water supply and the manner of storage, purification, or treatment of said supply before its delivery to the public, at any hearing before said board in any part of the State, as provided by law. The officer of said board presiding at any hearing shall have power to administer oaths and certify to all official acts of the board. After such hearings said board shall issue such final order as in its

judgment may be required to protect the public health, and notice of said final order shall be sent to all parties concerned.

SEC. 10. *Appeal from decision of State board of health.*—Any individual, firm, institution, or corporation dissatisfied with such order or final order of, or by the granting or refusal to grant any permit by the State board of health, or believing that such order granting or refusal to grant such permit to be illegal or unreasonable or that said order is not necessary for the protection of the public health, may, within 30 days after the making of said order or final order or the granting or refusal to grant such permit, appeal to any court of competent jurisdiction, and the said court shall render a decision approving, setting aside, or modifying the said order or final order or stating the conditions for the granting of said permit.

SEC. 11. *Penalty.*—Failure on the part of an individual, firm, institution, or corporation to obtain a written permit from the State board of health, as provided for under 5, or to comply fully with an order issued by said board, under the provisions of this act shall be deemed a misdemeanor and punishable by a fine of not less than $20 nor more than $100 for each offense, each day in which such failure is made being considered to constitute a separate offense. All penalties under this act are to be recovered by the State in civil action brought by the attorney general in the name of the Commonwealth.

SEC. 12. *Mandamus against cities.*—Any municipal corporation disobeying any order duly issued by the State board of health, under the provisions of this act, may be compelled to obey same by mandamus or other appropriate remedy by any court of competent jurisdiction.

SEC. 13. *Attorney general to represent board.*—In all actions and proceedings for the enforcement of orders of the State board of health, under the provisions of this act, the attorney general shall represent the said board, except in proceedings to which the State or any of its public institutions is a party defendant, and in such cases the board is authorized to employ special counsel.

[WATER-CLOSETS AND PRIVIES. REG. BD. OF H., MAY 5, 1916.]

4. *Prohibition of soil pollution.*—Every house or other place used as human habitation in the State, every place of business and every pleasure, recreation, or construction camp, shall be provided with a decent closet or privy where human excrement is so disposed of that the excrement can not endanger a source of drinking water and can not be accessible to flies or animals.

5. No person, firm, or corporation shall maintain or permit on premises owned by him any arrangement for the disposal of human excrement which may possibly endanger a source of drinking water or be accessible to flies or animals.

6. No person shall deposit any human excrement upon the surface of the ground or in any place where it may be exposed to flies or animals.

[WATER SUPPLY AND PURIFICATION SYSTEMS. REG. BD. OF H., MAY 5, 1916.]

1. *Date of application and required form.*—The information required by the State board of health in considering an application for a permit to supply water for drinking or domestic purposes to the public within the State of Virginia shall be submitted to the board at least two weeks in advance of the date on which it is proposed to begin work on the waterworks or extensions thereof and shall be submitted in the following scope and order:

(*a*) Application for permit.

(*b*) General and detail plans of proposed system or extension of existing system.

(*c*) Engineer's report.

(*d*) Specifications.

2. *Application for permit.*—The application for a permit and for the approval of plans shall be made by the individual, firm, institution, corporation, or municipal authorities for whom the work is to be done, or by their properly authorized agents, upon blank forms, which will be furnished by the health commissioner, said forms to be signed by the person, corporation, or officer applying for the permit and to be acknowledged before a notary.

3. *General and detail plans, form.*—One full set of general and detail plans shall be submitted with the application for a permit. Each plan shall be drawn to scale, shall be a true copy of the original, correct to date, and shall be a white, blue, or black line print or print from a reduced engraving. Pencil sketches will not be accepted. Copies of plans submitted will not be returned after submission unless revision is necessary or unless they have been presented for a preliminary review only. All copies of plans remaining in the hands of the board, after action thereon, are public records.

4. *Title of plans.*—In the lower right-hand corner of each separate drawing shall be placed a proper title containing name of individual, firm, institution, corporation, or municipality for whom it is made, the name of the locality to which it refers, a proper description of the nature of the drawing, the scale, date, and the name of the consulting or designing engineer. On each plan showing the locality, distribution system, or street layout the points of the compass shall be indicated.

5. *General layout of proposed systems or extensions.*—The general plan or map for a proposed waterworks system or the extension of an existing system shall show the location of all pipe lines and special structures, such as intake, pumping station, purification plant, reservoir, etc., with sizes or capacities clearly indicated. The size of pipe mains shall be written along the pipe; the location of hydrants, valves, and any special structures shall be shown and referenced in a legend near the title; and elevations of the principal parts of the system, such as water at intake, pumping station, purification plant, reservoir, etc., shall be given. If any part of the system, such as pumping station or purification plant, is subject to flooding, the elevation of the highest known flood water shall be given.

6. *Details of special units or structures.*—Complete detail plans of all special units and structures, such as intake, pumping station, reservoir, blow-offs, conduits, etc. (except those of standard cast-iron pipe) shall be submitted. Profiles of long conduits or pipe lines by which water is brought from a distance, either by gravity or by pumping, shall be shown. All emergency connections and valves by which water can be turned into the distribution system from any auxiliary or industrial supply shall be shown in detail and location of each indicated on the general plan.

7. *Details of purification plants.*—Plans for purification works shall include a general drawing, showing the layout of the various units, together with the piping system and reserve areas or future extensions indicated. The detail drawings shall include longitudinal and transverse sections sufficient to show the construction of each unit and part of the plant, special devices for feeding chemicals, for draining units, and such other information as is required for an intelligent understanding of the plans. Detailed designs of filter equipment submitted by filter companies, and made a part of the plans, shall be submitted for approval before construction of the plant begins.

8. *Details of wells and connections.*—Plans shall be submitted showing the depths and sizes of wells, the kind and depth of casing used, together with all

connecting pipe, valves, etc., and the layout of pumping stations, together with the arrangement and size of all suction pipe, force mains, and valves.

9. *Engineer's report.*—A comprehensive report written by the designing or consulting engineer shall be submitted with the plans, said report to be typewritten upon letter-size paper (8½ by 11 inches). The report shall contain the principal data upon which the designs were based and also information relative to the source of supply and methods of purification, in particular as follows:

(*a*) *Surface supply without purification.*—Nature and approximate area of watershed with special reference to any possible source of the contamination of the supply and methods recommended to prevent such contamination. Storage capacity and approximate dimensions of reservoir or lake, character of water, etc., shall also be discussed.

(*b*) *Surface supply with purification.*—General character of water with special reference to sewage pollution of stream within a distance of 5 miles above the intake. The purification plant shall be described with reference to the capacity of the plant as a whole and the capacity of each unit, rates of operation of each unit, chemicals to be used, and methods of application, any peculiar local conditions taken into account in the design, any special methods necessary in the maintenance and operation of the plant, and what degree of purification is expected or guaranteed.

(*c*) *Ground water supply.*—Full description of well or spring, nature of geological formation of the region, possible sources of contamination, means provided to prevent such contamination, character of the water, etc. Any available information or records of tests relative to the capacity or flow of the well or spring shall be given.

10. *Specifications.*—One copy of the detailed specifications covering all work to be done shall be submitted with plans for a new waterworks system or plans for the extension of or changes in an existing system. Specifications merely describing the general character of the work will not be accepted as sufficient. Specifications shall be on letter-size paper (8½ by 11 inches), except when printed in book form.

11. *Deviations from plans.*—There shall be no deviations from plans submitted to and approved by the board unless amended plans showing proposed changes shall be forwarded and approved by said board. Copies of approved plans, specifications, engineer's report, and application must be approved by and filed with the board before the contract is let.

WASHINGTON.

[CODES AND STATUTES, 1915.]

2266. *Punishment of misdemeanor when not fixed by statutes.*—Every person convicted of a misdemeanor for which no punishment is prescribed by any statute in force at the time of conviction and sentence, shall be punished by imprisonment in the county jail for not more than 90 days, or by a fine of not more than $250. (Laws, 1909, p. 894.)

2516. *Willfully poisoning springs, etc.*—* * * every person who shall willfully poison any spring, well, or reservoir of water shall be punished by imprisonment in the State penitentiary for not less than five years, or by a fine of not less than $1,000. (Laws, 1909, p. 972.)

2537. *Deposit of unwholesome substance.*—Every person who shall deposit, leave or keep on or near a highway or route of public travel, on land or water, any unwholesome substance; or who shall establish, maintain, or carry on upon or

near a highway or route of public travel, on land or water, any business, trade, or manufacture which is noisome or detrimental to the public health; or who shall deposit or cast into any lake, creek, or river, wholly or partly in this State, the offal from or the dead body of any animal, shall be guilty of a gross misdemeanor. (Laws, 1909, p. 978.)

2542. *Polluting springs and other sources of water supply.*—Every person who shall deposit or suffer to be deposited in any spring, well, stream, river, or lake, the water of which is or may be used for drinking purposes, or on any property owned, leased, or otherwise controlled by any municipal corporation, corporation, or person as a watershed or drainage basin for a public or private water system, any matter or thing whatever, dangerous or deleterious to health, or any matter or thing which may or could pollute the waters of such spring, well, stream, river, lake, or water system shall be guilty of a gross misdemeanor. (Laws, 1909, p. 979.)

2543. *Furnishing impure water.*—Every owner, agent, manager, operator, or other person having charge of any waterworks furnishing water for public or private use, who shall knowingly permit any act or omit any duty or precaution by reason whereof the purity or healthfulness of the water supplied shall become impaired, shall be guilty of a gross misdemeanor. (Laws, 1909, p. 979.)

5150–81. *Casting waste into waters of State.*—It shall be unlawful to cast or pass or to suffer or permit to be cast or passed into any waters of this State, either fresh or salt, within such distance from any incorporated city or town, any dead fish, heads or offal or other waste from any fish cannery, as the commissioner of public health may determine. (Laws, 1915, p. 103.)

5150–82. *Casting sawdust and trade wastes into waters of the State.*—It shall be unlawful to cast or pass or to suffer or permit to be cast or passed into any waters of this State, either fresh or salt, any sawdust, planer shavings, wood pulp, or other wastes, lime, gas, coculus indicus, chemical substances, or any refuse or waste material or matter deleterious to fish or shellfish, at any time whatsoever: *Provided, however,* That nothing in this act [section] contained shall be construed as prohibiting the depositing of coal-mine waste or drainage in any waters either fresh or salt. Any person who shall violate any provision of this act [section] shall be guilty of a misdemeanor. (Laws, 1915, p. 230.)

5150–117. *Penalty.*—Any person who shall violate or who shall fail to observe, obey, and comply with the provisions of this act for which no penalty is herein prescribed, shall be guilty of a misdemeanor.[1] (Laws, 1915, p. 116.)

5395–48. *Using poison with intent to take game fish.*—No person shall * * * use or prepare any drug, poison, lime, medicated bait, * * * fish berries * * * or any other deleterious substance whatever, * * * in any of the waters of this State with intent thereby to catch, take, or kill any game fish. Any person violating any of the provisions of this section shall be guilty of a misdemeanor. (Laws, 1913, p. 378.)

5395–50. *Casting sawdust in rivers or streams.*—Every person who shall cast or discharge or permit to be cast or discharged into any waters of this State any sawdust, planer shavings, or other lumber waste, shall be guilty of a misdemeanor.[2] (Laws, 1913, p. 379.)

5406. *Rules and regulations of State board of health—Investigation of water supplies.*—* * * The board [State board of health] may have special or

[1] This section applies to section 5150–81.

[2] See section 5150–82 above. Section 5150–82 appears in a law referring to "food fish," 5395–50 in a law referring to "game fish."

standing orders or regulations for the prevention of the spread of contagious or infectious diseases, and for governing the receipt and conveyance of remains of deceased persons, and such other sanitary matters as admit of and may best be controlled by universal rule. * * * It shall respond promptly, when called upon by the State or local government and municipal or township boards of health, to investigate and report upon the water supply, sewerage, disposal of excreta * * * of any place or public building. (Laws, 1901, p. 236.)

7507. *Cities of first class may prevent pollution of water supplies.*—Any such city [city of first class—20,000 or more population] shall have power—

(30) * * * to regulate and control, and to prevent and punish, the defilement or pollution of all streams running through or into its corporate limits, or for the distance of 5 miles beyond its corporate limits, and on any stream or lake from which the water supply of said city is taken for a distance of 5 miles beyond its source of supply * * *. (Laws, 1890, p. 218.)

7612. *Cities of second class may prevent pollution of water supplies.*—The city council of such city [city of second class—10,000 to 20,000 population] shall have power and authority—

(53) * * * to regulate and control and provide for the prevention and punishment of the defilement or pollution of all streams running in or through its corporate limits and a distance of 5 miles beyond its corporate limits, and of any stream or lake from which the water supply of said city is or may be taken and for a distance of 5 miles beyond its source of supply * * *. (Laws, 1907, p. 364.)

7671-14. *Cities of third class may prevent pollution of water supplies.*—The city council of such city [third-class cities—1,500 to 10,000 population] shall have power—

(*h*) * * * to purify and prevent the pollution of streams of water, lakes, or other sources of supply, and for this purpose shall have jurisdiction over all streams, lakes, or other sources of supply, both within and without the city limits. Such city shall have power to provide by ordinance and to enforce such punishment or penalty as the city council may deem proper for the offense of polluting or in any manner obstructing or interfering with the water supply of such city or source thereof. (Laws, 1915, p. 655).

7731. *Towns may prevent pollution of water supplies.*—The council of said town [towns or cities of fourth class—population less than 1,500] shall have power—

(11) * * * to prevent the pollution of streams of water running through such town, and for this purpose shall have jurisdiction for 2 miles in either direction * * *. (Laws, 1890, p. 201.)

7823. *Penalty for pollution municipal water supply.*—Any person who shall place or cause to be placed within any watershed from which any city or municipal corporation of any adjoining State obtains its water supply, any substance which either by itself or in connection with other matter will corrupt, pollute, or impair the quality of said water supply, or the owner of any dead animal who shall knowingly leave or cause to be left the carcass or any portion thereof within any such watershed in such condition as to in any way corrupt or pollute such water supply, shall be deemed guilty of a misdemeanor and upon conviction shall be punished by fine in any sum not exceeding $500. (Laws, 1909, p. 18.)

7990. *Municipal jurisdiction over water supplies.*—For the purpose of protecting the water furnished to the inhabitants of towns and cities within this State from pollution, the said towns and cities are hereby given jurisdiction over all property occupied by the works, reservoirs, systems, springs, branches, and pipes, by means of which, and of all the lakes, rivers, springs, streams, creeks,

or tributaries constituting the sources of supply from which such cities or town or the companies or individuals furnishing water to the inhabitants of such cities or towns obtain their supply of water, or store or conduct the same, and over all property acquired for any of the foregoing works or purposes or for the preservation and protection of the purity of the water supply, and over all property within the areas draining into the lakes, rivers, springs, streams, creeks, or tributaries constituting such sources of supply whether the same or any thereof, be within the corporate limits of such town or city or outside thereof; and authority is hereby conferred upon such towns and cities to prescribe by ordinance what acts shall constitute offenses against the purity of such water supply and the punishment or penalties therefor and to enforce said ordinances; and the mayor of such town or city is hereby authorized to appoint special policemen, with such compensation as the proper authorities of said town or city may fix, who shall, after taking oath, have the powers of constables under the laws of this State, and who may arrest with or without warrant any person committing, within the territory over which such town or city is given jurisdiction by this act, any offense declared by law of this State or by any ordinance of such town or city, against the purity of such water supply, or any violation of any rule or regulation lawfully promulgated by the State board of health for the protection of the purity of such water supply. Such policeman shall be, and he is hereby, authorized to forthwith take any such person arrested for any such offense or violation aforesaid, before any court having jurisdiction thereof to be proceeded with according to law. Every such special policeman shall, when on duty, wear in plain view a badge or shield bearing the words "Special police" and the name of the town or city for which he shall be appointed as aforesaid. (Laws, 1899, p. 114, as amended by Laws, 1907, p. 562.)

7991. *Pollution of water supplies declared a nuisance.*—The establishment or maintenance of any slaughter pen, stock-feeding yards, hogpens, or the deposit or maintenance of any uncleanly or unwholesome substance, or the conduct of any business or occupation, or the allowing of any condition upon or sufficiently near the sources from which the supply of water for the inhabitants of any such city or town is obtained, or where such water is stored, or the property or means through which the same may be conveyed or conducted so that such water would be polluted or the purity of such water or any part thereof destroyed or endangered, is hereby prohibited and declared to be unlawful and is hereby declared to be and constitute a nuisance, and as such to be abated as other nuisances are abated under the provisions of the existing law of the State of Washington, or under the laws which may be hereafter enacted in relation to the abatement thereof; and that any person or persons who shall do, establish, maintain, or create any of the things hereby prohibited for the purpose of or which shall have the effect of polluting any such sources of water supply or water, or shall do any of the things hereby declared to be unlawful shall be deemed guilty of creating and maintaining a nuisance and may be prosecuted therefor, and upon conviction thereof may be fined in any sum not exceeding $500. (Laws, 1899, p. 115.)

7992. *Proccdure in case nuisance is committed.*—If upon the trial of any person or persons for the violation of any of the provisions of this chapter such person or persons shall be found guilty of creating or maintaining a nuisance as hereby defined, or of violating any of the provisions of this chapter, it shall be the duty of such person or persons to forthwith abate such nuisance, and in the event of their failure so to do within one day after such conviction, unless further time be granted by the court, a warrant shall be issued by the court wherein such conviction was obtained, directed to the sheriff of the county

which such nuisance exists, and the sheriff shall forthwith proceed to abate the said nuisance, and the cost thereof shall be taxed against the party so convicted as a part of the costs of such case. (Laws, 1899, p. 115.)

7993. *Local authorities to enforce this act.*—It is hereby made the duty of the city health officer, city physician, board of public health, mayor of the city, or such other officer as may have the sanitary condition of such city or town in charge, to see that the provisions of this chapter are enforced and upon complaint being made to any such officer to immediately investigate the said complaint; and if the same shall appear to be well founded, it shall be, and is hereby, declared to be the duty of such officer to proceed and file a complaint against the person or persons violating any of the provisions of this chapter and cause the arrest and prosecution of such person or persons. (Laws, 1899, p. 116.)

7994. *Injunctions against maintenance of nuisances on watersheds.*—Any city supplied with water from any source of supply as hereinbefore mentioned, or any corporation owning water works for the purpose of supplying any city or the inhabitants thereof with water in the event that any of the provisions of this chapter are being violated by any person, may, by civil action in the superior court of the proper county, have the maintenance of the nuisance which pollutes or tends to pollute the said water, as provided for by section 7991, enjoined, and such injunction may be perpetual. (Laws, 1899, p. 116.)

8308. *Putting body of dead animal in watercourse, etc., a public nuisance.*—It is a public nuisance—

1. To cause or suffer the carcass of any animal or any offal, filth, or noisome substance to be collected, deposited or to remain in any place to the prejudice of others;

2. To throw or deposit any offal or other offensive matter, or the carcass of any dead animal, in any watercourse, stream, lake, pond, spring, well, or common sewer * * * or in any manner to corrupt or render unwholesome or impure the water of any such spring, stream, pond, lake, or well, to the injury or prejudice of others. (Laws, 1895, p. 19.)

8316. *Civil action.*—A private person may maintain a civil action for a public nuisance, if it is specially injurious to himself, but not otherwise. (Laws, 1875, p. 80.)

8320. *Punishment for public nuisance.*—Whoever is convicted of erecting, causing, or contriving a public or common nuisance, as described in this title [secs. 8307–8323], or at common law, when the same has not been modified or repealed by statute, where no other punishment therefor is specially provided, shall be punished by a fine not exceeding $1,000, and the court, with or without such fine, may order such nuisance to be abated, and issue a warrant as hereinafter provided.[1] (Laws, 1875, p. 81.)

COMMUNICABLE DISEASES—PREVENTION OF THE SPREAD OF, THROUGH FOOD OR DRINK. [REC. BD. OF H., JULY 15, 1912.]

SEC. 8. 1. No city or town shall hereafter empty or discharge its sewage into any body of water or stream used for drinking purposes by any municipality until such sewage has been rendered harmless by some method approved by the State board of health.

2. The use, except by diversion, of the waters of any natural or artificial storage or distributing reservoir of any public-water supply for any commercial or industrial purpose, is hereby prohibited.

3. Camping, picnicing, or hunting upon the watershed, or boating, fishing, or bathing in the waters of any public-water supply is hereby prohibited.

[1] It appears unnecessary to give the process of abatement of nuisances.

4. No person shall cut or store any natural ice to be sold or delivered within any incorporated city without first receiving a permit from the local health officer, which permit shall certify that the proposed source of such ice has been inspected and approved, and no natural ice stored or cut without such permit shall be sold in any incorporated city in this State.

WEST VIRGINIA.

[CODE, 1916, CHAP. 47, CITIES, TOWNS, AND VILLAGES.]

28. *Cities, towns, and villages may prevent pollution of water supplies.*—The council of such city, town, or village shall have plenary power and authority therein * * * to prevent injury to or pollution of the same [waterworks], or to the water or healthfulness thereof * * *. (Acts of 1882, chap. 92, as amended by acts of 1905, chap. 53.)

[CODE, 1916, CHAP. 62, FISH, GAME, FORESTS, AND STREAMS.]

45a. *Depositing in streams matter injurious to fish; drainage of water from mines.*—It shall be unlawful for any person, firm, or corporation to throw, discharge, or cause to enter into any stream, watercourse, or water in this State sawdust or other matter deleterious to the propagation of fish. It shall be lawful, however, to drain or cause to be drained from any mine in the State by the owner or operator thereof the water that naturally collects in such mine and the water from any coal washery, and to discharge the same into any stream, watercourse, or water in the State: *Provided, however*, That any mine from which the water is so discharged or drained shall be kept in a sanitary condition and the water draining or flowing from such mine, and from such washery, shall, while in the mine and on the premises of the mine owner or operator, be kept free from pollution by human or animal excrement or substance deleterious to health. And the State board of health, its agents, employees, and servants shall at all seasonable times have authority to enter upon the premises and into any such mine in order to see that the same is kept in a sanitary condition and that the waters draining therefrom are free from the objectionable substance named herein; with the right to the State board of health to prevent any mine owner or mine operator who fails to comply with the provisions of this act [section] from draining or discharging the water or waters from his or its mine into any stream, water, or watercourse in the State: *Provided further*, That any mine owner or operator having one suitable, convenient, and sufficient outlet for the water from his or its mine into one stream shall not cause the same to be drained into any other stream. Any person, firm, or corporation violating any of the provisions of this section shall be guilty of a misdemeanor and fined not less than $15 nor more than $100 for each and every such offense: *Provided*, That no prosecution to enforce this section shall be instituted or conducted without the consent and approval of the forest, game, and fish warden; such consent to be evidenced in writing and filed and entered of record in the court or before the justice and in his docket in which or before whom the prosecution is begun or pending. (Acts of 1915, chap. 47, as amended by second extra session, 1915, chap. 5.)

47. *Use of drugs to kill fish.*—It shall be unlawful for any person to kill or attempt to kill any fish * * * by the use of any poisonous drug, substance, bait, or food or by the use of * * * lime or other thing of like nature. And the placing of any such articles in any stream, pond, or lake shall be deemed and taken to be prima facie proof of intention to violate this section. Any person violating this section shall be guilty of a felony and upon convic-

tion thereof shall be confined in the penitentiary for a period not less than six months nor more than two years, and may, at the discretion of the court, be fined not less than $50 nor more than $200. (Acts 1867, p. 72, as amended by 1909, chap. 60.)

48. *Furnishing drugs, etc., for use in killing fish.*—It shall be unlawful for any person, firm, or corporation to sell, give, or furnish, directly or indirectly, * * * any poisonous drug, bait, or food to any person when such person, firm, or corporation knows or has reason to believe that * * * such poisonous drug, bait, or food are intended to be used for the purpose of killing fish. Any person, firm, or corporation violating this section shall be guilty of a misdemeanor and upon conviction thereof shall for each offense be fined not less than $25 nor more than $100, and may, at the discretion of the court, be confined in the county jail not exceeding 30 days. (Acts, 1909, chap. 60.)

[CODE, 1916, CHAP. 144, OFFENSES AGAINST THE PERSON.]

7. *Pollution of water supply with intent to injure.*—If any person * * * poison any spring, well, or reservoir of water, with intent to kill or injure another person, he shall be confined in the penitentiary not less than 3 nor more than 18 years. (Acts, 1882, chap. 118.)

[CODE 1916, CHAP. 150, PUBLIC HEALTH.]

1. (2) *Commissioner of health to inspect sanitary condition of streams.*—His [commissioner of health's] duties shall be to * * * inspect and report the sanitary conditions of streams, sources of water supply, and sewerage facilities * * *.

2. *Rules and regulations of State department of health.*—* * * Whenever the character and location of plumbing, drainage, water supply, sewers, and disposal of sewage, garbage, or other waste materials of cities, towns, and villages, offensive trades, hotels, and labor camps * * * are such as to endanger the public health, the public health council shall have power to make and enforce rules regulating the same. It shall promulgate and recommend regulations, not inconsistent with law, governing the disposal of excreta in coal mines, * * *. Nothing herein contained shall be construed to give the State department of health the power to regulate or interfere with the drainage from any mine or manufacturing plant unless the drainage from said mine or manufacturing plant shall contain disease-producing bacteria in sufficient numbers to endanger health. * * * (Acts, 1915, chap. 11.)

20c. *Depositing dead animals, etc., in waters used for domestic purposes.*—If any person or persons shall knowingly and willfully throw or cause to be thrown into any well, cistern, spring, brook, or branch of running water which is used for domestic purposes any dead animal, carcass or part thereof, or any putrid, nauseous, or offensive substance, he or they shall be guilty of a misdemeanor and upon conviction thereof shall be fined not less than $5 nor more than $100 and may, at the discretion of the jury, be confined in the jail of the county not exceeding 90 days, and shall, moreover, be liable to the party injured in a civil action for damages. (Acts, 1872–8, chap. 176.)

20d. (1) *Depositing dead animals, slops, or putrid substance in waters of State.*—It shall be unlawful to put the carcass of any dead animal, or the offal from any slaughterhouse, butcher's establishment, or packing house, or slop or other refuse, from any hotel or a tavern, or any spoiled meats or spoiled fish, or any putrid animal substance, or the contents of any privy vault, upon or into any river, creek, or other stream within this State * * *. (Acts, 1887, chap. 25.)

(3) *Penalty.*—A justice of the peace shall have jurisdiction of any offense against the provisions of this act [20d (1)], committed within his county. Any such offense shall be punished by a fine of not less than $5 nor more than $20 * * *. Upon conviction for any such offense the accused must bury at least 3 feet under the ground, or destroy by fire, any of the things named in the first section [20d (1)], which he has placed in any of the waters * * * named in such section * * * within 24 hours after such conviction; and if he shall fail so to do, the justice shall further fine him not less than $10 nor more than $50. (Acts, 1887, chap. 25.)

WISCONSIN.

[STATUTES 1915.]

1406m. *Water survey and examination of water supplies.*—* * *. 4. The purpose of this laboratory [State laboratory of hygiene] shall be to undertake the examination of water supplies for domestic purposes * * *. The examination of water supplies shall include the establishment of a water survey of the State * * *.

1407. *Water-supply plans to be approved by the State board of health.*—* * *. Before any city or village shall institute a water system or system for water supply for the domestic use of its inhabitants, or a system of sewerage for the disposition of its sewage, such city or village shall submit to the State board of health the plans and specifications for such system, and both of the water system and the sewerage system if a sewerage system exists or is proposed, and the State board of health shall examine such plans and specifications for the proposed system and the sanitary and hygienic features thereof; and no such system shall be installed or put in operation until the State board of health shall issue its certificate that such proposed system will not be in any respect insanitary or dangerous to the public health.

1407a–6. *Rules and regulations of State board of health.*—* * *. 3. The board [State board of health] shall have power to adopt and enforce rules and regulations governing the duties of all health officers and health boards, and any violation of said rules shall be punished by a fine of not less than $10 nor more than $100 for each offense. * * *

4. All rules and regulations adopted and published by the State board of health * * * shall be in force and shall be prima facie lawful; and all such * * * rules and regulations shall be valid and in force and prima facie reasonable and lawful until they are found otherwise in an action brought for that purpose or until altered or revoked by the State board of health. * * *

1407m. *Survey of sanitary properties of water supplies.*—1. The State board of health is authorized to act with the United States Geological Survey in determining sanitary and other conditions and nature of the natural water supplies of the State of Wisconsin, such water survey to have for its objects:

(*a*) To determine the nature and condition of the unpolluted natural water supplies of the State.

(*b*) To determine to what extent the natural waters are being contaminated by sewerage [sic] from cities.

(*c*) To determine to what extent the natural waters are being polluted by industrial wastes, such as come from glucose factories, creameries, and such other sources which produce pollution, and in what way these wastes might be utilized for beneficial purposes.

(*d*) To investigate water-borne diseases and assist in determining the best source of water supplies.

2. The State board of health is hereby empowered and instructed to make ch rules and regulations in conjunction with the United States Geological epartment as may be necessary to carry into effect the provisions of this act.

1407m–1. *Pollution of streams, etc.; complaints; investigation; notification.*—henever the common council, town board, village board, or board of health any city, incorporated village, or township makes complaint in writing to e State board of health that a city, village, corporation, or person is disarging or permitting to be discharged any sewerage [sic] or other waste into y stream, watercourse, lake, or pond, and is thereby creating a public nuisance trimental to health or comfort, or is polluting the source of any public water pply, it shall be the duty of the State board of health to forthwith investiate, or cause to be investigated, the conditions complained of; and whenever e State board of health finds after careful investigation that the source public water supply of any city, village, or community in this State is being bject to contamination, or has been rendered impure by reason of discharge sewerage or other wastes, or whenever said board finds that such sewerage other waste have so corrupted any stream, watercourse, lake or pond, and at that contamination, impurity, or corruption is detrimental to the public alth, it shall notify such city, village, corporation, or person causing the ntamination, corruption, or pollution of any such stream, watercourse, lake, nd, or banks adjacent thereto, of its findings.

1407m–2. *Notice in writing; approval of governor.*—The State board of health rough its executive secretary shall notify such city, village, corporation, or rson in writing, setting forth the decision of the board in regard to the conitions complained of. The city, village, corporation, or person shall be given a opportunity to be heard within 15 days after receiving the decision of the ard. If after such hearing the State board of health determines that improvements or changes are necessary for the preservation of health and should e made, it shall report its findings to the governor, and upon his approval id board shall notify such city, village, corporation, or person to install such orks as may be necessary for purifying or otherwise disposing of its sewage other wastes, so as to preserve the public health, or to change or enlarge isting works in such manner as may be necessary to preserve the public alth; such works or means must be completed and put into operation within time to be fixed by said board.

1407m–3. *Appeal from orders of board; referee engineers.*—If in any case ny order of the State board of health, when approved by the governor and ade in pursuance to the provisions of sections 1407m–1 to 1407m–6 inclusive, not acceptable to any city, village, corporation, or owner affected thereby, ch city, village, corporation, or owner shall have the right of appeal as folws, to wit: The necessity for and reasonableness of such order may be subitted to two reputable and experienced sanitary engineers, one to be chosen y the city, village, corporation, or owner to which such order of the State oard of health applies, and the other chosen by the State board of health, who hall not be regularly employed by said board, and who shall act as referee ngineers. If the engineers so chosen are unable to agree, then they shall hoose a third engineer of like standing, and the vote of the majority shall be he decision of the referee engineers. The referee engineers herein provided or shall affirm or modify the order of the State board of health submitted to hem so as to preserve the public health when necessary or reasonable to do so, nd their decision, as reported in writing to the State board of health, with ecommendations, which shall be rendered within a reasonable time, shall be nforced by said board in the manner provided for in sections 1407m–1 to

1407m–6, inclusive. The fees and expenses of said referee engineers shall be paid by the city, village, corporation, or owner requesting such referee.

1407m–4. *Use of impure ice prohibited.*—No town, city, village, public institution, individual, or water or ice company shall use water or ice which is so contaminated, unwholesome, and impure that the use thereof endangers the public health. The State board of health, after full investigation of the facts, may prohibit any town, city, village, public institution, individual, or water or ice company from using water which is so contaminated, unwholesome, and impure that the use thereof endangers the public health; and the circuit court shall have jurisdiction and power, upon application therefor by the State board of health, to enforce by proper order and decree the orders, rules, and regulations of the said board of health, made under and by virtue of this section for the protection of the public health.

1407m–5. *Penalty.*—If any council, department, or officer of any municipality, or person, or private corporation shall fail or refuse to do and perform any act or acts required of him, it, or them to be done and performed by sections 1407m–1 to 1407m–6, inclusive, such members of the council or department and such officer or officers or person or private corporation shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be fined a sum of not more than $500 nor less than $100 for each offense.

1407m–6. *Duty of attorney general.*—It shall be the duty of the attorney general to act as legal adviser to the State board of health, and assist such board in the enforcement of the provisions of sections 1407m–1 to 1407m–4, inclusive.

1418. *Maintaining slaughterhouse on bank of river, etc.*—No person shall erect, maintain, or keep any slaughterhouse upon the bank of any river, running stream, or creek, or throw, or deposit therein any dead animal or any part thereof, or any of the carcass or offal therefrom; nor throw or deposit the same into or upon the banks of any river, stream, or creek, which shall flow through any city, village, or organized town containing 200 or more inhabitants * * *; and every person who shall violate any of the provisions of this section shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished for each such violation, by a fine of not less than $10 nor more than $100, or by imprisonment in the county jail not exceeding six months; and the mayor of the city, president of the village, and the chairman of the town in which any such slaughterhouse is located shall have power to and shall cause the same to be immediately removed; and every such officer who shall knowingly permit any slaughterhouse to be used or maintained contrary to the provisions of this section shall forfeit not less than $15 nor more than $50. * * *

1454. *Cemeteries not to be built near watering places.*—1. No person, association, or corporation shall lay out or establish any cemetery grounds or use any lot or grounds for burial purposes (except such as are now in use for such purposes) * * * within 15 rods of any * * * watering place * * *.

2. Any violation hereof shall be deemed a nuisance and may be restrained by injunction at the suit of any person * * *.

62.32.[1] *Fishing with stupefactives or medicated bait; depositing deleterious substance in waters.*—(1) Except as expressly provided in this chapter, no person shall take, capture, or kill fish of any variety in any waters of this State by means of * * * poisonous or stupefying substances; * * *.

[1] A decimal system is used for numbering sections recently added to the Wisconsin statutes. The "62" refers to the number of the chapter,

(2) Except as expressly provided in this chapter, no person shall use, set, lay, or prepare in any of the waters of this State any lime, poison, medicated bait, fish berries, or any other substance deleterious to fish life * * *.

(3) Except as expressly provided in this chapter, no person shall cast, deposit, or throw overboard from any boat, vessel, or other craft into any waters within the jurisdiction of the State, or deposit or leave upon the ice thereof until it melts, any fish offal [meaning dead fish, or the head, intestines, blood, and cleanings of fish];[1] or throw or deposit, or permit to be thrown or deposited, into any waters within the jurisdiction of the State any lime, tanbark, ship ballast, stone, sand, slabs, decayed wood, sawdust, sawmill refuse, planing-mill shavings, or any acids of chemicals or waste or refuse arising from the manufacture of pulp, paper or beet sugar, or any other substance deleterious to fish life other than authorized drainage and sewage from municipalities.

(4) Subsection (3) shall not apply to Kickapoo River; Pine River, in Richland County; Balsam Branch, in Polk County; Chippewa River, from the mouth of Thornapple River to its mouth; Flambeau River, from the dam at Ladysmith to its mouth; Jump River, from its fork in town 34 north, range 2 west, to its mouth; Leavitt Creek that empties into Jump River in town 33 north, range 3 west; Black River, from the Falls Dam down to the boundary of Jackson County; and Wisconsin River, from the north boundary line of the city of Rhinelander to its mouth.

1636—197. *Pure-water supply for tenement houses, etc.*—Every apartment house, tenement house, lodging or boarding house shall have water furnished in sufficient quantity at one or more places on each floor occupied by one or more families, provided the said apartment, tenement, lodging or boarding house is located on a street or alley supplied with the city water pipes. When said building is not so situated a sufficient supply of wholesome water shall be provided on a part of the lot where it will not be contaminated from closets, barns, garbage, or other sources of impurity."

4384. *Prohibiting poisoning of spring.*—Any person who * * * shall willfully poison any spring, well, or reservoir of water, with such intent [to kill or injure any other person], shall be punished by imprisonment in the State prison not more than 10 years nor less than 1 year.

4468a. *Interference with free use of water a misdemeanor.*—Any person who shall wantonly interfere with the free use of the water from any spring or in any creek or stream running across or in any highway shall be guilty of a misdemeanor and be liable to any person damaged thereby for all damages sustained.

4562d. *Penalty for violating certain fish laws.*—(1) Any person who, for himself, or by his agent, servant, or employee, or who, as agent, servant, or employee for another, violates any of the provisions of chapter 62 of the statutes, relating to wild animals, is guilty of a misdemeanor, and shall, in addition to any other liability, forfeiture, or penalty prescribed in said chapter for such violation, be punished, respectively, as follows:

(*b*) For any violation of * * * subsections (1) or (2) of section 62.32, prohibiting the use of * * * poisons, stupefactives, and medicated baits * * * by a fine of not less than $50 nor more than $150, or by imprisonment in the county jail not less than 60 days nor more than 90 days, or by both such fine and imprisonment.

(*e*) For any violation of any other provision of said chapter, by a fine of not less than $25 nor more than $100, or by imprisonment in the county jail not less than 30 days nor more than 90 days, or by both such fine and imprisonment.

[1] Given in brackets in Wisconsin Statutes of 1915.

4570a. *Throwing mill waste into waters.*—Any person who shall carry, throw into or in any manner deposit in any lake or bay within this State connected with the great chain of lakes and navigable for vessels or steamers, or cause so to be carried, thrown, or deposited therein, any sawdust, shavings, edgings or other mill waste shall be punished for the first offense by fine not exceeding $10; and for any subsequent offense committed within 1 year from conviction by fine not exceeding $20, or imprisonment in the county jail not more than 1 month nor less than 10 days. * * *

4607k. *Impure ice.*—No person or corporation shall sell or offer for sale or cause the same to be done within this State, for domestic, culinary, or drinking purposes, any ice which contains mud, decayed vegetation, animal or foreign matter, or malarial substance. Every person or corporation offering ice for sale shall have posted on his or its wagons, in a conspicuous manner, the name of the place from which the ice so offered for sale was cut, harvested or manufactured, and all persons or corporations dealing in or handling impure ice, to be used for cooling purposes only, shall have their wagons so labeled. Any person who, or corporation which, violates any of the provisions of this section shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be punished by a fine of not less than $50 nor more than $100.

[INDUSTRIAL CAMPS—SANITARY REGULATION. REG. BD. OF H., JAN. 9, 1914.]

REGULATION 1. Hereafter operators, contractors, and all other persons who may establish an industrial camp or camps for the purpose of logging, ice cutting, or any like industry, or for the purpose of construction of any road, railroad, or other work requiring the maintenance of camps for men engaged in such work, or any other temporary or permanent industrial camp of whatever nature, shall report to the State health officer concerning the location of such camp or camps, and shall arrange and maintain such camp or camps in a sanitary condition as outlined in these regulations.

REG. 2. The term "camp," as used in these regulations shall include any lumbering, mining, railway construction, or other camp where men are employed and housed in temporary quarters, such as cars, tents, buildings, or other inclosures other than the bona fide homes of the employees.

REG. 4. The general scheme of the structure of the camps should be as follows: Stable and kitchens should be separated by a distance as great as consistent with the natural topography of the land and so located as to prevent any pollution of the water supply with the necessity for convenient access to the stables. The stables and toilets for the men in the camp must be so located that their natural drainage is away from the water supply.

REG. 5. The use of the toilets provided for the men should be made obligatory, and instant discharge of any employees polluting the soil must be rigidly enforced.

REG. 11. Waste water from the kitchen, wash, and bunk houses in summer camps must be carried to trenches lined with quicklime and at a safe distance from water supply.

REG. 13. The supply of water for the camp should be carefully decided upon, and an adequate supply free from any possible chance of contamination must be provided.

REG. 19. Privy vaults shall be so constructed at every camp that they can be effectively cleaned of the contents. Pits shall not be less than 4 feet in depth, and the contents shall be treated daily, when used during the summer season, either by a solution of milk of lime (strong whitewash of fresh slaked lime), 1 gallon to every square yard of pit, or the sprinkling of 5 pounds of

powdered chloride of lime to the same area. A liberal sprinkling of fresh chloride of lime shall also be applied daily to the floors of privies and lavatories. All closets shall be at least 100 feet distant from the water supply, and so located that drainage from privy vaults toward water supply is impossible.

WYOMING.

[COMPILED STATUTES, 1910.]

1608. *Town council may prevent pollution of water supply.*—* * * the town council shall enact ordinances * * * to prevent the pollution of the water [supply] * * *.

1609. *Town council may acquire property outside of limits for waterworks and may prevent water being polluted.*—For the purpose of establishing or supplying waterworks any town may go beyond its territorial limits and may take, hold, and acquire property by purchase or otherwise; * * * and the jurisdiction of the town to prevent or punish any pollution or injury to the stream or source of water, or to such waterworks, shall extend 10 miles beyond its corporate limits, or so far as such waterworks may extend.

1808. *Jurisdiction of city to prevent pollution of water supplies outside of city.*—The corporation constructing such waterworks [for supplying city with water] shall have the right to extend the same beyond the corporate limits of the city or town, and the jurisdiction of such city or town, for the purpose of maintaining and protecting the same from injury and the water from pollution, shall extend over the entire territory occupied by such works.

1876. *Acquisition of water beyond corporate limits to prevent pollution, etc.*—For the purpose of carrying out any of the powers conferred by this chapter [chap. 129, entitled "Waterworks—Bonds"] any city or town may go beyond its corporate limits and may take, hold, and acquire property by purchase or otherwise. It shall have power to take and condemn all necessary lands and property therefor, in the manner provided by the laws of the State, relating to the condemnation of real estate by railroad companies, and for the purpose of preventing any pollution or injury to the streams, spring, or source of supply of its waterworks, ditches, or reservoirs its jurisdiction shall extend up and along such stream or source of supply for a distance not exceeding 10 miles beyond its corporate limits, or further if such water supply shall be obtained at a greater distance, and shall include and extend over the entire distance occupied by such waterworks, ditches, or reservoirs.

2815. *Contamination of streams by industrial wastes.*—Any owner or owners of any sawmill, reduction works, smelter, milling, refining, or concentration works, or other manufacturing or industrial works, or any agent, servant, or employee thereof, or any other person or persons whomsoever, who shall throw or deposit in, or in any way permit to pass into any natural stream or lake within this State, wherein are living fish, any sawdust, chemicals, mill tailings, or other refuse matter or deleterious substances, or poisons of any kind or character whatsoever, that will or may tend to the destruction or driving away from such waters any fish, or kill or destroy any fish therein, or that will or may tend to pollute, contaminate, render impure or unfit for domestic, irrigation, stock, or any other purpose for which appropriated and used, the waters of any such natural stream or lake * * * shall be deemed guilty of a misdemeanor and upon conviction thereof shall be fined not less than $50 or more than $100, or shall be imprisoned in the county jail not less than 30 days or more than six months, or both such fine and imprisonment for each offense; and where any of the foregoing unlawful acts are committed continuously each

of the days upon which committed shall be treated and considered as a separate and distinct offense: *Provided*, That nothing in this or the succeeding section shall apply to the slag from smelter furnaces.

2816. *Use of poisons for destroying fish, etc.*—Any person who shall kill or destroy [any fish] in any of the waters of this State by the use of any poison or deleterious drug, chemical, or substance whatsoever * * * shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined not less than $50 nor more than $200, and shall be imprisoned in the county jail not less than 90 days or more than 6 months: *Provided*, That nothing in this section contained shall prevent the owner or owners of any quartz mill, reduction works, smelter, sawmill, or other manufacturing or industrial works in the State now located or to be hereafter located upon any natural stream or lake, or other collection of waters, from operating or working said quartz mill, reduction works, sawmill, or other manufacturing or industrial works if the said owner or owners thereof shall build or cause to be built a suitable dam to be used in connection with said quartz mill, smelter, reduction works, sawmill, or other manufacturing or industrial works, which dam shall be so constructed as to prevent any tailings, sawdust, chemicals, or other refuse, deleterious, or poisonous substances from passing into such stream or lake which shall destroy or drive away the fish or any number of them from said stream, lake, or other waters, or pollute, contaminate, render impure, or unfit such waters for domestic, stock, irrigation, or other uses for which appropriated, * * *.

2938. *State board of health to investigate pollution public water supplies.*—Said board is authorized and empowered to investigate and ascertain, as far as possible, in relation to the pollution of streams and natural waters of this State by artificial causes, or of all waterworks and water systems belonging to any city or town in this State and supplying water for the inhabitants thereof, which in their judgment may be necessary to determine the sanitary and economic effects of such pollution, and to enter in and upon the grounds, buildings, and premises, waterworks, reservoirs, pipe lines, pump houses, and everything connected with the collection and distribution of water to the inhabitants of any city or town; to make, institute, and conduct needful experiments pertaining thereto, and shall have power to summon witnesses, administer oaths, and hear evidence relating to such matters, and to make full report to the city or town authorities of their operations and investigations in writing; and it shall be the duty of all such officers, when notified of any unsanitary conditions of streets, alleys, sidewalks, waterworks, or other public ways, structures, or improvements under their control, to at once take steps to repair, cleanse, abate, or destroy the same.

2952. *Rules and regulations of State board of health.*—The State board of health shall have power to prescribe rules and regulations for the management and control of communicable diseases, and to prescribe and fix penalties for the violation or refusal to obey such rules and regulations. And any person or persons violating or refusing to obey such rules and regulations or resisting or interfering with any officer or agent of said State board of health while in the performance of his duties shall be deemed guilty of a misdemeanor and upon conviction thereof shall be punished by the imposition of such penalty as may have been designated by the said State board of health for the violation of said rule or regulation. Or, in the discretion of the court, said person may be punished by a fine of not more than $100, or imprisonment not exceeding 30 days, or both such fine of $100 and imprisonment for 30 days.

5805. *Pollution of water supply with intent to injure.*—Whoever poisons any spring, well, cistern, or reservoir of water, with intent to injure or kill any human being, shall be imprisoned in the penitentiary not more than 14 years.

5958. *Pollution or obstruction of watercourses.*—If any person, company, or corporation * * * shall in anywise pollute or obstruct any watercourse, lake, pond, marsh, or common sewer, or continue such obstruction or pollution, so as to render the same unwholesome or offensive to the county, city, town, or neighborhood thereabouts; every person, company, or corporation so offending shall, upon conviction thereof, be fined not more than $100; and every such nuisance may, by order of the district court before whom conviction may take place, be removed or abated by the sheriff of the proper county.

5965. *Deposition of carcasses, etc., in watercourses.*—If any person or persons association of persons, company, or corporation shall deposit, place or put, or cause to be deposited, placed or put, upon or into any river, creek, bay, pond, canal, ditch, lake, stream, * * * the carcass of any dead animal, or the offal or refuse matter from any slaughterhouse, butcher's establishment, meat market, packing house, fish house, hogpen, stable, or any spoiled meats, spoiled fish, or any animal or vegetable matter in a putrid or decayed state, or liable to become putrid, decayed, or offensive, or the contents of any privy vault, or any offensive matter or substance whatever, or shall cause to be maintained any privy, slaughterhouse, meat market, or any other or different place, building, or establishment, that shall directly or indirectly be the cause of polluting the waters of any spring, reservoir, stream, lake, or water supply used wholly or partly for domestic purposes, or if the owner or owners, tenant or tenants, occupant or occupants of any lands or tenements, dwellings or places of business, or any other and different places or localities, whether defined in this section or not, shall knowingly permit any of the said offensive matters or substances, or any other and different offensive matters or substances to remain in any of the aforesaid places or other and different places or localities, or shall permit any of the aforesaid places to be maintained which shall cause the pollution of any stream, spring, reservoir, lake, or water supply, either directly or indirectly, in any locality, place, or situation in this State, to the annoyance of the citizens or residents of this State, or any of them, or to the detriment of the public health, or who shall neglect or refuse to remove or abate the nuisance, offense, or inconvenience occasioned or caused thereby within 24 hours after knowledge of the existence of such nuisance, offense, or inconvenience, in or upon any of the above-described premises or places, or any other and different place or locality, owned or occupied by him, her, it, or they, or after notice in writing from the sheriff, deputy sheriff, or coroner of any county in this State, or the constable of any precinct, or the marshal or any of the policemen of any city, town, or village in which said nuisance shall exist, or from any peace officer in this State of the locality wherein such nuisance shall exist, every such person so offending shall be guilty of a misdemeanor, and upon conviction thereof, shall be punished by a fine of not less than $10 nor more than $50, and if such nuisance is not abated within 48 hours after the same is created or exists to the knowledge of such offender, or within 48 hours after said written notice is given, such failure to abate such nuisance shall be deemed a second offense against the provisions of this section, and every like failure and neglect to abate such nuisance of every 24 hours thereafter shall be considered an additional offense, and shall be subject to a like penalty as herein provided.

5966. *Nuisance to be abated.*—It shall be the duty of the officer mentioned in the preceding section, who shall receive notice, or who shall have knowledge of any such nuisance as is therein defined and mentioned, to cause the same to be abated and removed forthwith, if the owner or owners, occupant or occu-

pants of said premises neglect or fail so to do, and all c
abating and removing the same shall be chargeable to the
creating, causing, or permitting the continuance of such nuisa
of the officer causing the same to be abated and removed; *

5967. *Pollution of water supply with sawdust.*—If any person
may own, run, or have charge of any sawmill in this State shal
mit the sawdust therefrom to be thrown or placed in any ma
river, stream, creek, bay, pond, lake, canal, ditch, or other water
State, such person or persons shall be liable to a like penalty
in section 5965.

DO NOT DESTROY—

When you have no further use for this pamphlet give it to someone else.

O

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 88
SEPTEMBER, 1917.

LIBRARY OF
S. H. OSBORN M. D.

MALARIA CONTROL:

REPORT OF DEMONSTRATION STUDIES CONDUCTED IN URBAN AND RURAL SECTIONS

NOV 27 Rec'd
NOV 27 Filed
NOV 7 1937

By

R. C. DERIVAUX
Assistant Surgeon
United States Public Health Service
and
H. A. TAYLOR AND T. D. HAAS
Field Directors

PREPARED BY DIRECTION OF THE SURGEON GENERAL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

TABLE OF CONTENTS.

	Page.
Introduction:	
Purpose of demonstrations and selection of units	7
Some factors in the epidemiology of malaria in southeastern Arkansas	8
The town unit, Crossett, Ark.:	
General description	11
Preliminary operations	13
Control measures	16
Results	25
Acknowledgments	33
The rural units, vicinity of Lake Village, Ark.:	
General description	34
Preliminary operations	35
"Negative" control group	38
Control measures	39
Results	45
Acknowledgments	54
Summary	54

ILLUSTRATIONS.

FIGURES.

1. Condition of important stream prior to control operations	13
2. Vegetation overgrowth on streams prior to clearing	13
3. Log pond, upper corner	13
4. Fish pond—Character of vegetation	13
5. Cremer pond, a detail	13
6. Type of borrow pit	13
7. Barrel	13
8. Pit near mill (later drained)	13
9. Street ditching	17
10. Street ditching	17
11 and 12. "Pot hole" elimination on ditch E	17
13 and 14. Treatment of Anopheles breeding place	17
15 and 16. Treatment of Anopheles breeding place	17
17. Effect of storm	23
18. A drained borrow pit, formerly a prolific breeding place	23
19 and 20. A railroad borrow pit, before and after filling	23
21. Draining a borrow pit	23
22. Seepage interception	23
23. Oil can on stream B	23
24. Knapsack sprayer in use	23
25. Borrow pit	35
26. Barrels	35
27. Type of door screen used	35
28. Type of window screen used	35

Page.
29. Type of tenant house..... 35
30. Type of tenant house..... 35
31. Tenant house, structural details..... 35
32. Chimney protection..... 35

CHARTS.

1. Total professional visits for malaria and other conditions, Crossett, 1916.... 29
2. Calls for malaria, 1915 and 1916, Crossett..... 31
3. Reported cases of malaria, Crossett, 1916..... 32

MAPS.

1. Index map, antimalaria operations, 1916, Crossett..... 17
2. Spot map showing house distribution of reported cases of malaria, 1916, Crossett..... 26
3. Plantations in vicinity of Lake Village, Ark., antimalaria operations, 1916.. 41
4. Yellow Bayou plantation, portion included in antimalaria operations, 1916.. 42

MALARIA CONTROL: A REPORT OF DEMONSTRATION STUDIES CONDUCTED IN URBAN AND RURAL SECTIONS.

INTRODUCTION.

PURPOSE OF DEMONSTRATIONS AND SELECTION OF UNITS.

The extensive prevalence of malaria and its untoward influence have made the problem of its control foremost among the questions engaging the attention of sanitarians and economists in the Southern States. It is doubtful whether the losses due, directly and indirectly, to malaria are possible of accurate computation, but from studies under special conditions and from gains following control campaigns, it is evident that the economic losses are very large, and that there occurs annually an appalling amount of preventable illness.

The desirability of determining more definitely the relative values of the several known methods of malaria control with reference to conditions in the United States has long been appreciated because of the widely varying conditions of which malarial incidence is a resultant. Demonstrations at a number of places in the United States have amply proved the economic practicability of malaria control, notably at Roanoke Rapids, N. C., and at Electric Mills, Miss.,[1] where substantial results were obtained following the systematic application of combined measures. In neither of these places, however, has the influence of any single procedure been determined.

Division of problem.—For the purposes of these studies a division of the problem into two sections was made, as follows: A town or community unit, in which antimosquito measures alone would be applied, and a rural unit, in which each family or house would receive individual consideration and be protected through the use of screening or quinine in "immunizing doses," supplemented by the "sterilization" treatment of proven carriers upon detection by blood examination.

Selection of localities.—Two localities were selected after preliminary surveys of a number of places and reference to data accumulated in

[1] "Demonstrations of Malaria Control," von Ezdorf, R. H. Reprint No. 328 from Public Health Reports (Mar. 10, 1916).

Service investigations of malaria in the Southern States. It was believed that the flat country of the Mississippi Delta region would provide the conditions best suited to the requirements of the problem as an intensive study; accordingly, selection was made of two points in southeastern Arkansas—i. e., Crossett, Ashley County, as a "town unit," and a group of plantations in the vicinity of Lake Village, Chicot County, as a "rural unit."

SOME FACTORS IN THE EPIDEMIOLOGY OF MALARIA IN SOUTHEASTERN ARKANSAS.

Throughout southeastern Arkansas malaria is widely prevalent in severe form, and exerts a sinister influence on the sanitary and economic well-being of a large population, more especially in the flats of the Arkansas and Mississippi River Valleys and of their tributary streams and bayous. In the rich water-laid soil of the so-called "bottoms" vegetation is prolific, and valuable agricultural and timber resources could be fully utilized were it not for the well-known insalubriety of these regions; histories of families suffering repeated attacks of malaria annually are common, and instances are known where farming and lumber enterprises have been abandoned because of decimation of the working personnel by malaria. Favorable climatic conditions, a high rate of endemic infection, ample opportunities for Anopheles propagation and access to people, the almost total absence of efficient protective measures, and a preponderance of agricultural industries all contribute toward making malaria the chief cause of all illness in this region and responsible for a high proportion of pernicious attacks, hemoglobinuric fever, and deaths.

In connection with investigations conducted by the United States Public Health Service, the prevalence of malaria in Arkansas has been determined through the issuance of circular postal cards to physicians and health officers throughout the State. In 1914 there were issued 24,000 cards, of which 4,153, or 17.3 per cent, were returned and 23,941 cases of malaria reported; this would be equivalent to about 138,000 cases for the State, or about 8 per cent of the total population of 1,686,480 for the same year, had 100 per cent of the cards been returned and the same proportion maintained.

The parasite index of endemic infection, as determined by thick film blood examinations in connection with Service investigations, has been found to vary in Arkansas between 1.97 and 22.49 per cent. Of a total of 3,996 specimens examined, taken from 11 places, parasites were found in 463, or 11.58 per cent.

Anopheles mosquitoes.—Three species of *Anopheles* occur commonly in southeastern Arkansas, and all have been incriminated as transmitters of malaria. In their order of frequency and importance these are: *Anopheles quadrimaculatus* Say, *Anopheles punctipennis*

Say, *Anopheles crucians* Wiedemann. In addition to the above named, two others, i. e., *Anopheles walkeri* Theobald, and *Coelodiazesis barberi*, are reported by Thibault [1] as taken by him in Pulaski and Lonoke Counties (central Arkansas).

Climatic and seasonal conditions.—Climatic conditions are favorable to the production of malaria for about six months of the year, beginning ordinarily in May and terminating with the advent of the first frosts, usually in October.

The greatest incidence of malaria is attained during August, September, and October, and it is unusual for hemoglobinuric fever and other severe types of malaria to be seen outside of these months.

The annual rainfall for the section measures about 52 inches, and the mean annual temperature is approximately 64° F. The following tables, compiled from data collected at Portland (Ashley County), Ark., Huttig (Union County), Ark., and Greenville (Washington County), Miss., where observation stations of the Weather Bureau are maintained, are believed to be illustrative of conditions for the region generally:

TABLE 1.—*Climatologic data, Portland (Ashley County), Ark.*

[Elevation, 122 feet.]

Year.	Temperature (Fahrenheit).					Precipitation (inches).					Killing frosts.	
	Annual mean.	Highest.	Month.	Lowest.	Month.	Total for the year.	Greatest monthly.	Month.	Least monthly.	Month.	Last in spring.	First in autumn.
1910	63.4	97	Aug...	13	Feb...	48.63	7.25	July...	0.73	Sept..	Apr. 25	Oct. 22
1911	65.8	102	June..	9	Jan...	65.37	15.51	Dec...	.84	Sept..	Feb. 23	Nov. 3
1912	61.7	99	Sept..	11	Jan...	46.29	11.91	Mar...	1.20	Oct...	Mar. 16	Do
1913	63.4	105	Aug...	21	Jan...	58.67	8.67	Jan...	1.53	June..	Mar. 28	Oct. 21
1914	63.7	106	July...	13	Dec...	45.51	7.12	Mar...	.38	Oct...	...do.....	Oct. 28
1915	62.9	106	June..	20	Jan...	52.96	9.82	May...	.84	Sept..	Mar. 31	Oct. 10
1916	63.5	98	Aug...	13	Jan...	45.24	9.05	Jan...	1.40	Feb...	Apr. 9	Oct. 21

TABLE 2.—*Monthly precipitation, Portland, Ark., 1910 to 1915.* [2]

	1910	1911	1912	1913	1914	1915	Average. [2]
January	5.52	4.23	2.29	8.67	1.26	5.03	4.5
February	3.37	5.13	1.95	5.96	4.80	5.90	4.51
March	3.05	3.19	11.91	5.60	7.12	2.67	5.59
April	2.94	8.62	6.15	4.94	4.59	1.32	4.76
May	6.36	1.38	4.16	4.69	6.65	9.82	5.51
June	6.52	5.68	3.37	1.63	1.87	4.76	3.95
July	7.25	8.75	3.81	3.19	3.28	4.99	5.21
August	2.64	6.86	1.36	3.08	4.86	3.91	3.78
September	.73	.84	1.41	7.62	.75	.84	2.03
October	2.52	1.87	1.20	5.47	.38	3.03	2.41
November	.93	3.31	2.19	3.95	3.66	4.60	3.1
December	4.80	15.51	6.49	3.97	6.29	6.09	7.19
Total	46.83	65.37	46.29	58.67	45.51	52.96	.....

Average, 52.9 inches annual mean.

[1] Thibault, "Notes on the Mosquitoes of Arkansas," Proc. Entomologic Society, Washington, Vol. XII, 1910.

[2] These monthly averages are given in the absence of "Normals," which have not as yet been established.

TABLE 3.—*Climatologic data, Huttig (Union County), Ark.*

[Elevation, 85 feet.]

Year.	Temperature (Fahrenheit).					Precipitation (inches).					Killing frosts.	
	Annual mean.	Highest.	Month.	Lowest.	Month.	Total for the year.	Greatest monthly.	Month.	Least monthly.	Month.	Last in spring.	First in autumn.
1910	64.6	98	Aug...	10	Feb...	48.53	8.32	June..	0.91	Mar...	Apr. 25...	Oct. 29
1911	66.8	104	June..	8	Jan...	50.59	12.50	Dec...	.03	Sept..	Feb. 25...	Nov. 2
1912	63.4	99	July...	11	Jan...	50.12	12.87	Mar...	.56	Nov...	Mar. 25...	Do.
1913	64.4	102	Sept..	21	Jan...	65.17	14.11	Sept..	1.42	June..	Mar. 28...	Oct. 28
1914	64.4	103	July...	14	Dec...	42.91	8.90	Mar...	.75	Jan...	Mar. 23...	Do.
1915	64.2	100	July...	19	Jan...	47.11	6.77	May..	.73	Sept..	Mar. 31...	Nov. 15
1916	64.6	100	July...	14	Jan...	42.38	8.49	Jan...	.41	Feb...	Mar. 4....	Oct. 22

TABLE 4.—*Climatologic data, Greenville, Miss.*

Year.	Temperature (Fahrenheit).					Precipitation (inches).				
	Annual mean.	Highest.	Month.	Lowest.	Month.	Total for the year.	Greatest monthly.	Month.	Least monthly.	Month.
1910	64	97	July.....	13	February.	47.50	6.58	January...	0.20	March.
1911	66	103	June.....	7	January...	72.84	19.97	December.	1.21	May.
1912	63	101	September	10	January...	52.48	11.95	March.....	.82	July.
1913	65	102	August....	23	February.	57.91	10.95	September	1.02	August.
1914	64	102	June.....	15	December.	47.97	7.69	March.....	.57	October.
1915	64	100	July.....	22	January...	45.91	7.25	February.	1.36	April.

THE TOWN UNIT, CROSSETT, ARK.

R. C. DERIVAUX and H. A. TAYLOR.

GENERAL DESCRIPTION.

Crossett, selected as the "town unit" for the demonstration of malaria control through the application of antimosquito measures (control of production), is situated in Ashley County, southeastern Arkansas, about 12 miles north of the Louisiana line. The town was built 16 years ago by the Crossett Lumber Co. in a rich pine region, and has since developed into one of the best known and most prosperous lumber communities in the South. Of the total population of 2,029, the lumber mills require about 750 men for their operation and constitute the sole industrial organization; they are supplied from two logging camps in the woods, 16 and 26 miles south of Crossett, respectively, and are said to have a daily output of about 300,000 feet of lumber.

Crossett lies at the edge of the "uplands" of Ashley County, at an elevation of 165 feet above sea level. The topography of the town site is fairly flat, with gentle undulations, and natural drainage is toward the east, south, and west. The soil is almost uniformly of a light brown color, and has been classed as "Richland silt loam." [1] Together with its subsoil it is of moderately compact texture, and is fairly pervious. Climatic conditions for the past two years are illustrated in Tables 5 and 6, prepared from the Weather Bureau annual reports for the Arkansas section:

TABLE 5.—*Monthly mean temperatures, Crossett, Ark.*

	1915	1916		1915	1916
	° *F.*	° *F.*		° *F.*	° *F.*
January	.....	52.2	July	81.0	80.8
February	49.7	47.8	August	77.8	.....
March	46.1	58.2	September	77.2	72.8
April	66.2	63.0	October	64.8	64.8
May	74.2	72.9	November	56.4	54.8
June	79.5	77.2	December	49.1	49.7

[1] "Soil Survey of Ashley County, Ark." Bureau of Soils, U. S. Department of Agriculture, Mar. 13, 1914.

TABLE 6.—*Precipitation, Crossett.*

	1915	1916		1915	1916
	Inches.	*Inches.*		*Inches.*	*Inches.*
January	.....	7.81	August	4.76	2.9
February	4.51	.50	September	.62	1.2
March	3.49	1.98	October	1.84	2.2
April	1.29	2.80	November	6.56	1.8
May	7.03	5.79	December	5.12	2.6
June	3.92	8.61			
July	4.24	3.93	Total	.....	47.8

Crossett is accurately laid out and occupies an area measuring about one-half by 1 mile. The lumber mills and yards lie north of the Iron Mountain Railroad right of way and the town proper south. Streets and avenues, 90 feet in width, running north and south and east and west, divide the town symmetrically into blocks measuring 450 by 350 feet, each divided by a wide alley; the central street, Main, serves as a boundary line between the white and colored residential sections. The streets are unpaved but kept in condition by scraping and oiling. Some of the principal sidewalks are paved.

With the exception of the church and school properties, the town is owned and administered by the lumber company. The houses, which are of frame construction and contain from 3 to 10 rooms, are well spaced and supplied with water and electric light. Nearly all are fairly well screened with 16-mesh galvanized-iron wire screening.

The water supply is derived from 7 bored wells, between 110 and 140 feet in depth. The water is of excellent quality, and is distributed throughout the town at a pressure of 50 pounds for domestic use and 100 pounds for fire use.

The sewerage system is as yet incomplete. Two septic tanks receive the sewage from a part of the eastern half of town; in the remainder of the eastern half and in the western half, the colored section, dry earth privies of the open ("E") type are in use; these are limed frequently, and are cleaned at weekly intervals by a scavenger, the contents being hauled and buried. Garbage is kept in covered galvanized-iron containers, and is collected weekly for destruction by burning.

The medical staff of the Crossett Lumber Co. consists of a chief surgeon, Dr. J. T. Sparks, who is also health officer, and two associates, Dr. G. H. Setzler and Dr. C. L. Vines, the latter being resident physician at the camps. In addition, two physicians are engaged in private practice. A hospital of about 20 beds and a dispensary is maintained for the medical and surgical relief of employees and their families.

As may be seen from Map 1, p. 17, and figs. 1–8, facilities for mosquito propagation have been unusually abundant in Crossett, and have comprised almost every variety of breeding place. The town

FIG. 1.—CONDITION OF IMPORTANT STREAM, CROSSETT, PRIOR TO CONTROL OPERATIONS.

FIG. 2.—VEGETATION OVERGROWTH ON STREAMS PRIOR TO CLEARING.

FIG. 3.—LOG POND, UPPER CORNER, CROSSETT.

FIG. 4.—FISH POND; CHARACTER OF VEGETATION.

FIG. 5.—CREMER POND, CROSSETT, TYPE OF MOSQUITO-BREEDING AREA.

FIG. 6.—TYPE OF "BORROW PIT," CROSSETT.

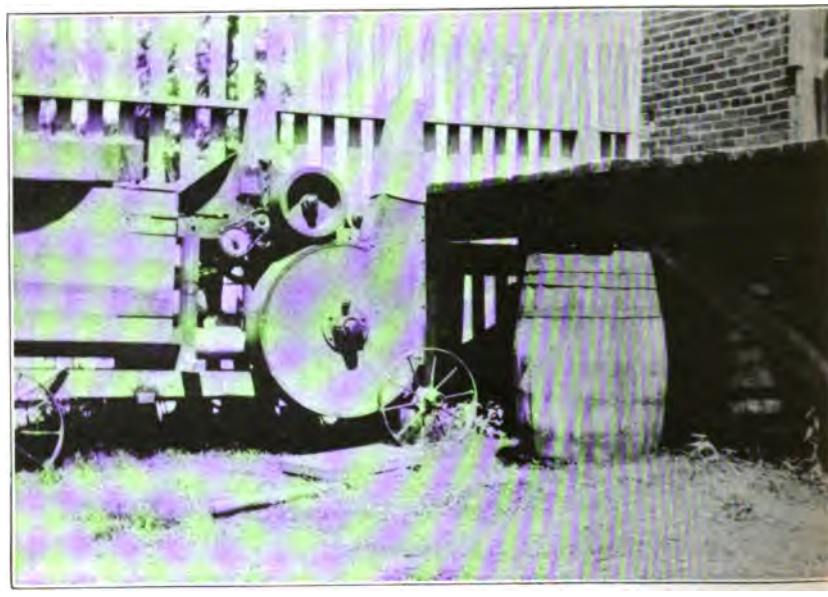


FIG. 7.—BARREL, FOUND BREEDING ANOPHELINES.

FIG. 8.—BORROW PIT NEAR MILL, CROSSETT. LATER DRAINED.

proper is traversed by a number of street ditches serving as gutters and storm sewers and communicating with several large "branches," which course through and around the edges of the town; all of these have in the past contributed more or less extensively toward mosquito prevalence. Artificial ponds of several acres each lie north of the lumber mills, the nearer serving as a "log pond," and the farther, which has been well stocked with game fish, as a "fish pond." The log pond (fig. 3) has fairly clean edges, and its waters are somewhat agitated. These features, together with its minnow content, effectually prevent mosquito breeding. The fish pond (fig. 4) is separated from the log pond by a narrow dam, an earthwork embankment. Near the shores its waters are very shallow and thickly grown with coarse grass, lilies, willows, and other aquatic vegetation. In the protected portions mosquitoes were found to breed, though not profusely. A third pond, recently made, is situated about seven-eighths of a mile northeast of the mills, and a fourth, Cremer Pond (fig. 5), about three-fourths of a mile southwest of town; as no breeding was observed to occur in their waters, and because of their distance from town, it was not found necessary to include them in control operations. Other propagation places about Crossett included the borrow pits along railroad rights of way (fig. 6), the numerous water barrels placed throughout the lumber mills and yards for fire protection, and the usual containers found on premises.

PRELIMINARY OPERATIONS.

History index of malaria.—A sanitary census and a history index of malaria were taken of the entire town at the beginning of operations with a view to ascertaining general sanitary conditions about houses and premises, the amount and condition of screening, and to what degree malaria had prevailed during the preceding seasons. As will be noted in the summaries given later, most of the windows and doors, more especially in the section occupied by whites, are recorded as "screened." This screening, while better than the average, could be classed in but few instances as wholly efficacious.

During the census search was incidentally made for artificial containers serving, or likely to serve, as temporary breeding places of mosquitoes, and where such were found, corrective measures were recommended.

Table 7 gives the more important sanitary data elicited in this census. The data for Cremer Town is given separately. This place, formerly the village of the now closed Cremer Mill, is a collection of 16 houses, located about one-half mile southwest of Crossett. The residents are now employed in and about Crossett.

TABLE 7.—*Sanitary data elicited in preliminary census.*

	Crossett.			Cremer Town.
	White.	Colored.	Both.	
Total population	1,139	890	2,029	
Number of houses	249	218	474	
Number of occupied houses	242	214	463	
Number of unoccupied houses	7	4	11	
Number of families	242	214	463	
Percentage of houses occupied	97.2	98.1	97.6	
Average length of occupancy.....years	3.7	3.5	3.6	
Average number of occupants per house	4.7	4.15	4.3	
Number of—				
Outbuildings	365	209	574	
Chicken yards	142	185	327	
Privies	234	211	445	
Stables	87	26	113	
Hydrants	418	218	636	
Windows—				
Total	2,419	1,179	3,598	
Screened	2,378	835	3,213	
Percentage screened	98.3	70.8		
Doors—				
Total	795	652	1,447	
Screened	782	336	1,118	
Percentage screened	98.3	51.5		
Flues—				
Total	451	251	702	
Screened	5	0	5	
Percentage screened	1.1	0		
Porches—				
Total	418	243	661	
Screened	12	0	12	
Percentage screened	2.9	0		

[1] Months.

The history index of malaria is given in the following table:

TABLE 8.—*History index of malaria.*

CROSSETT.

	Total.	Giving positive histories of malaria.	History index.
			Per cent.
Total white and colored population	2,029	503	24.7
Males over 15	658	194	29.4
Females over 15	601	146	24.2
Males under 15	377	71	18.8
Females under 15	393	92	23.4
Total white population	1,139	254	22.3
Males over 15	329	94	28.5
Females over 15	322	63	19.5
Males under 15	244	45	18.4
Females under 15	244	52	21.3
Total colored population	890	249	27.9
Males over 15	329	100	30.3
Females over 15	279	83	29.7
Males under 15	132	26	19.6
Females under 15	149	40	26.8

CREMER TOWN.

Total	78	35	44.8
Males over 15	21	10	47.6
Females over 15	19	11	57.9
Males under 15	11	6	54.5
Females under 15	17	8	47.0

Parasite index.—A preliminary parasite index was made at the beginning of operations by examination of thick blood films obtained from a representative proportion of the population, chiefly school children. The technique observed was that in use in service investigations and described by von Ezdorf.[1] The results obtained in the preliminary index are presented in the following summary:

TABLE 9.—*First parasite index—Crossett, Ark., May, 1916.*

Age.	Number examined.						Total.
	White.			Colored.			
	Male.	Female.	Total.	Male.	Female.	Total.	
1 to 5	2	1	3	12	10	22	25
5 to 9	61	70	131	18	52	70	201
10 to 14	70	78	148	19	52	71	219
15 to 19	37	29	66	18	27	45	111
20 to 29	1	6	7	2	20	22	29
30 to 39	1	.....	1	5	8	13	14
40	.....	.....	.....	2	3	5	5
Total	172	184	356	76	172	248	604

Age.	Number positive.						Total.	Type of parasite.		
	White.			Colored.				Tertian.	Estivo-autumnal.	Total.
	Male.	Female.	Total.	Male.	Female	Total.				
1 to 5	1	.....	1	1	.....	1	2	2	.....	2
5 to 9	6	2	8	2	1	3	11	9	2	11
10 to 14	11	11	22	4	4	8	30	26	4	30
15 to 19	5	2	7	.....	4	4	11	11	.....	11
20 to 29	.....	1	1	.....	1	1	2	.....	2	2
30 to 39	.....	.....	.....	.....	1	1	1	1	.....	1
40	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total	23	16	39	7	11	18	57	49	8	57

	Per cent.
White index	10.95
Colored index	7.25
Total	9.43

Reported Incidence of Malaria.—In the opinion of local physicians, malaria has constituted about 60 per cent of all illness in and about Crossett. Of recent years, a progressive decrease, both as to number of cases and severity of type, is said to have occurred, and pernicious forms and hemoglobinuric fever are now uncommon, whereas formerly both were fairly frequent. Five cases of hemglobinuric fever are recorded as having occurred in 1912, two in 1913, two in 1914, and none since.

[1] "Malarial Index Work." Von Ezdorf, R. H. Reprint 159 from Public Health Reports (Dec. 26, 1913.)

The following table is compiled from the records of the Crossett Hospital, and exhibits such data with reference to malaria as were summarized for the chief surgeon's annual report for 1915:

TABLE 10.—*Professional visits and hospital admissions in 1915.*

	For malaria.	For other causes.	Total.	Percentage for malaria.
Admissions to hospital	50	178	228	21.9
Office consultations	788	5,782	6,570	12.0
Residence visits	1,664	2,716	4,380	38.0
	2,502	8,676	11,178	22.4

From the foregoing, it will be noted that of the total of 11,178 professional visits of physicians of the lumber company, 2,502, or 22.4 per cent, were because of malaria, clinically diagnosed; this does not represent the total amount of malaria actually occurring in Crossett in 1915, as it fails to include such calls as were made by private practitioners or such cases as failed to receive medical attention. An index, however, is provided for comparative purposes.

At the beginning of operations in April, 1916, the monthly distribution of the recorded visits for malaria during 1915 was determined by conference with the physicians and reference to available records. Chart 2 (p. 31) shows this monthly distribution contrasted with a similar distribution for 1916.

CONTROL OPERATIONS.

In Crossett the measures employed for the control of malaria have consisted exclusively of procedures directed against mosquito propagation, and have included drainage, clearing and training of streams, and control of artificial containers, etc., over an area about one-half mile square.

Active work was begun on April 10, 1916. After systematic survey of the locality, a detailed map of the town and its environments was prepared, showing all streams, ditches, borrow pits, and other breeding places. For purposes of accurate record and reference, each stream was designated by letter, and its subdivisions by subnumber (A2, D3, etc.), and so indicated on the maps; street ditches were designated as such, and borrow pits and other special breeding places were referred to by name or location. (Map 1.)

Ditching.—Under this heading is included all treatment of old streams and ditches, and the cutting of such new ditches as were required for the drainage of wet areas and borrow pits. (See figs. 9–12.) This work was performed by a gang of colored laborers, usually under the direction of the field director or sanitary inspector.

FIG. 9.—STREET DITCHING, CROSSETT.

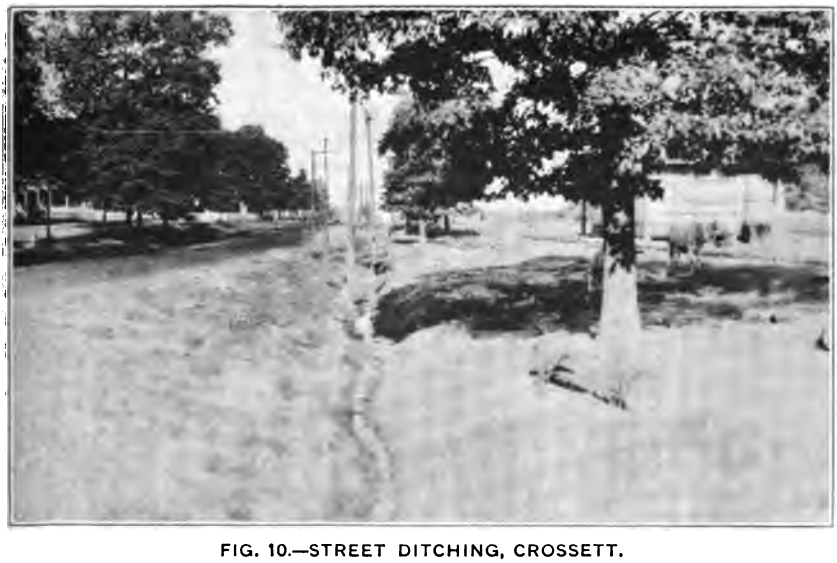


FIG. 10.—STREET DITCHING, CROSSETT.

FIG. 11.—STREAM "E," "COLORED TOWN," CROSSETT, SHOWING "POT HOLES."

FIG. 12.—SAME STREAM AS IN FIG. 11, SHOWING RECHANNELING.

FIG. 13.—ANOPHELES BREEDING PLACE, "COLORED TOWN," CROSSETT.

FIG. 14.—SAME DITCH AS SHOWN IN FIG. 13, AFTER CLEARING.

FIG. 15.—PROLIFIC SOURCE OF ANOPHELES, HORSE-LOT DRAIN, CROSSETT.

FIG. 16.—SAME AS FIG. 15, AFTER TREATMENT.

old streams and ditches, all overhanging trees and brush were moved for a distance of from 2 to 8 feet from both banks, the dges and banks were cleared of vegetation and straightened, the ottoms freed of obstructions and recut to narrow channel of semi-liptical cross section. In this way pools were eliminated and ater concentrated for offflow or subsequent oiling if needed. For

MAP 1.—Index map, Crossett, Ark. Antimalarial operations, 1916.

orrow pit and wet area drainage and for the interception of seepage, few narrow ditches were cut, usually communicating with one of he permanent watercourses. Street ditches were cleared of vege-ation, and their channels recut to facilitate drainage. (Figs. 13–16.)

In the following tables are presented summaries of the ditching perations, with their respective costs, separated into "Old streams

and ditches," "New ditching," and "Street ditching." In the first two groups each stream or ditch is referred to by letter corresponding with its designation on the maps, the subdivisions being shown by number. All costs are charges to each subdivision for labor of first work, maintenance, and oil applied; the costs of the application of the oil are given separately.

TABLE 11.—*General summary of ditching operations.*

Old streams cleared and treated	linear yards	9,24
New ditching installed	do	3,17
Street ditch cleared	do	4,84
Total ditching (exclusive of maintenance)	do	17,26
Maintenance, recleaning of ditches	do	8,26
Total area cleared, timber, brush, etc., removed on sides of stream, square feet		429,63
Average depth of streams and ditches	feet	
Average middle width	do	

TABLE 12.—*Ditching operations, old streams and ditches.*

Stream.	Subdivision	Linear yards.	Average depth.	Average width.	Cost, first work.	Drip-can stands.	Drip cans.	Gallons oil, sprayed and dripped.							Cost of oil, at 12½ cents a gallon.	Maintenance.		Total cost.
								June.	July.	August.	September.	October.	November.	Total.		Linear yards reclaimed.	Cost.	
			Feet.	*Feet.*														
"A"	A1	425	3	3	14.00	1	1	40	15	20	20	10	10	115		425	$7.00	
	A2	275	3	3½	40.50	2	2	20	10	15	20	5	5	75		275	5.00	
	A3	297	4½	4	16.00	3	2	.....	.....	15	.....	.....	.....	15		250	5.00	
Total		997			70.50	6	5	60	25	50	40	15	15	205	$25.625	950	17.00	$113.125
"B"	B1	540	2½	3½	16.95	6	3	24	15	25	20	10	10	104		250	7.00	
	B2	90	3	2½	7.00	1	1	16	10	10	15	.....	.....	51		.....	.....	
	B3	422	2	3	12.00	4	2	.....	.....	.....	.....	.....	.....	.....		265	4.00	
Total		1,052			35.95	11	6	40	25	35	35	10	10	155	19.375	515	11.00	66.325
"C"	C1	165	3½	3	11.00	1	1	10	5	5	10	5	.....	35		100	4.00	
	C2	142	2	4	13.00	1	1	10	5	.....	5	.....	.....	20		100	2.75	
Total		307			24.00	2	2	20	10	5	15	5	.....	55	6.875	200	6.75	37.625
"D"	D1	383	3	6	12.25	3	1	20	15	15	10	5	5	70		383	9.00	
	D2	320	4	7	11.00	3	2	30	10	30	30	15	15	130		320	11.00	
	D3	467	5	6	15.27	5	3	30	15	15	40	.....	.....	100		447	5.00	
Total		1,170			38.52	11	6	80	40	60	80	20	20	300	37.50	1,150	25.00	101.02
"E"	E1	275	2	3	6.00	2	2	10	10	20	15	5	5	65		.....	.....	
	E2	325	3	4	14.00	2	2	30	15	30	20	10	5	110		300	7.00	
	E3	305	4	3	12.70	2	2	10	15	10	15	.....	.....	50		200	4.00	
Total		905			32.70	6	6	50	40	60	50	15	10	225	28.125	500	11.00	71.825
"F"	F1	383	2	3	12.00	.....	.....	10	20	5	10	10	.....	55		383	5.00	
	F2	399	3	4	22.00	1	1	.....	.....	.....	15	.....	.....	15		363	7.60	
Total		782			34.00	1	1	10	20	5	25	10	.....	70	8.75	746	12.00	54.75

TABLE 12.—*Ditching operations, old streams and ditches*—Continued.

Stream.	Subdivision.	Linear yards.	Average depth.	Average width.	Cost, first work.	Drip-can stands.	Drip cans.	Gallons oil, sprayed and dripped.							Cost of oil, at 12½ cents a gallon.	Maintenance.		Total cost.
								June.	July.	August.	September.	October.	November.	Total.		Linear yards reclearned.	Cost.	
			Feet.	*Feet.*														
"G"	G1	275	2	3	26.05	2			10					10		200	5.00	
	G2	500	3	4	16.63	4			15					15		350	7.75	
Total		775			42.68	6			25					25	3.125	550	12.75	58.555
"H"	H1	600	2	3	14.00	4	1									525	7.00	
	H2	235	2	3	27.00	2										235	11.00	
Total		835														760	18.00	59.00
"I"	I1	350	1	3½	18.00											100	3.25	
		503	2	3	25.00											200	4.75	
Total		853			43.00											300	8.00	51.00
"J"	J1	469	2	3	23.65											130	4.50	
	J2	350	2	3	11.00											300	7.35	
Total		819			34.65											430	11.85	46.50
"L"	L1	349	3	4	17.00													
	L2	200	2½	3	4.00													
Total		549			21.00													21.00
"O"	O1	200	2½	4	41.00													41.00
Totals		9,244			459.00	49	27	260	185	215	245	75	55	1,035	129.375	6,101	133.35	721.725
Miscellaneous recleaning, after rains, weed removal, etc																2,160	14.00	
Yard maintenance charged																8,261	147.35	

NOTE.—Cost of application of oil by spray is not included.

TABLE 13.—*Ditching operations—New ditches.*

Stream.	Division.	Linear yards.	Average depth.	Average width.	First work, cost.	Gallons of oil sprayed and dripped.							Cost, oil at 12½ cents a gallon.	Total cost.
						June.	July.	August.	September.	October.	November.	Total.		
"K"	K1	200	4	3	$17.00	30	10	....	15	....	....	55		
Borrow-pit drain	K2	195	2	2½	13.00	....	10	....	5	....	....	15		
		395	....	....	30.00	30	20	....	20	....	....	70	$8.75	$38.75
"M" (horse-lot drain)	....	272	2	2½	14.00	....	....	....	....	....	....	....	.....	14.00
"N" (cotton-gin drain, etc.)	....	978	2½	4	55.00	....	....	....	....	....	....	....	.....	55.00
Oak grove crowfoot	....	320	½	1	26.60	....	....	....	....	....	....	....	.....	26.60
Miscellaneous small laterals	....	1,212	....	....	78.50	....	....	....	....	....	....	....	.....	78.50
Total	....	3,177	....	....	204.10	....	....	....	....	....	....	....	8.75	212.85

TABLE 14.—*Ditching operations—Street ditches.*

Total yards	4,844
First cost	$195.12
Gallons of oil sprayed and dripped:	
June	35
July	52
August	60
September	43
October	35
November	33
Total	258
Cost of oil, at 12½ cents a gallon	$32.25
Total cost	$227.37

TABLE 15.—*Cost summaries, ditching and reclearing operations.*

	Total linear yards.	Total costs.	Cost per linear yard.	Cost per linear foot.
Old streams and ditches	9,244	$459.00	$0.04965	$0.01655
New streams and ditches	3,177	204.10	.06424	.0214
Street ditching	4,844	195.12	.04028	.01342
Maintenance	8,261	147.35	.01783	.00594

Maintenance of streams and ditches.—Nearly all of the more important streams and ditches were recleaned throughout in midsummer (July), this work being charged to each stream subdivision in the summaries. In addition, such maintenance work was done as was necessary following storms (fig. 17) and damage by hogs and stock; passage of a "hog law in May," however, diminished damage from this latter source to an almost negligible amount.

In this section weed growth is rapid, and recutting was found necessary after three or four weeks' growth along the banks. In addition to the general reclearing in July, weeds were again cut in August on

two of the principal streams, "A" and "D," and in places along the courses of several of the lesser ones.

Borrow pits and their treatment.—Wherever possible borrow pits made in connection with construction enterprises were filled (figs. 19–20), otherwise drained (figs. 18 and 21) or oiled by spraying. All three of the railroads entering Crossett contributed to the success of the control operations by having a number of the pits situated along their respective rights of way filled by their section crews; the cost of these operations has been given by the several companies and is summarized in the following table:

Arkansas, Louisiana & Midland R. R.	$10.50
Iron Mountain R. R.	100.00
Rock Island R. R.	105.90
[1]	216.40

Fish-pond control.—Control operations were undertaken in but one of the four ponds in the vicinity, i. e., the "fish pond," of which the southern edge lay within flight range of town and in which the prolific growth of vegetation along the shallow edges caused a limited amount of mosquito production. Because of frequent fluctuations in the water level, protection of larvæ against fish was possible to some extent in the southeastern corner where the water was shallow and where barriers were left when the water level was diminished. Accordingly 1¼ acres in this corner were cleared of grass and other growth and a few broad-channel shallow ditches, totaling 170 linear yards, cut to permit of free access of small fish at all times; the cost of this work was $47.50.

Artificial container control.—Wherever possible artificial containers serving or likely to serve as mosquito-breeding places, were eliminated by removal or emptying. A large number requiring treatment remained, however, including the 311 water barrels on or about the trams or in the yards of the lumber mills. For these and other barrels control was secured through the use of a salt substance, so-called niter cake, a by-product of the manufacture of explosives consisting of anhydrous sodium sulphate and acid sodium sulphate. This material, a grayish hygroscopic salt, was found to be lethal to larvæ and pupæ and to prevent the development of ova in a dilution of 1:400. Accordingly, 1 pound was placed in each of the 311 fifty-gallon barrels and stirred into solution on May 29, 1916; at repeated subsequent inspections no propagation was at any time observed. This substance was also used to inhibit mosquito breeding in a brick cistern (a reserve fire-control water supply at the rear of No. 1 mill). This cistern, about 8 feet in diameter and containing about 14 feet of

[1] Since this expense represents corrections by the railroads of sanitary nuisances created by them in construction works, the propriety of inclusion of these costs in final compilations is questionable.

FIG. 17.—EFFECT OF STORM. CROSSETT.

FIG. 18.—A DRAINED BORROW PIT, CROSSETT, FORMERLY A PROLIFIC BREEDING PLACE.

FIG. 19.—RAILROAD BORROW PIT, CROSSETT.

FIG. 20.—SAME BORROW PIT SHOWN IN FIG. 19, AFTER TREATMENT BY FILLING.

FIG. 21.—DRAINING A BORROW PIT.

FIG. 22.—SEEPAGE INTERCEPTION, TOE AT FISH POND EMBANKMENT, CROSSETT.

FIG. 23.—OIL CAN, DRIP, ON STREAM "B," CROSSETT.

FIG. 24.—KNAPSACK SPRAYER IN USE.

water, was formerly a prolific source of mosquitoes, principally Culex. It was treated once with 200 pounds of niter cake and required no further attention.

Oiling.—The extent to which oil was used in connection with control operations is indicated in the foregoing tables, showing the relative amounts and costs of oil applied to the several streams and ditches after preliminary clearing and training. In the amounts charged to "Street ditches" is included such oil as was used for spraying of temporary pools and other water collections following rains, and of which no separate cost records are given.

After trial of a number of samples of oils, including kerosene, a rather heavy black oil, graded by dealers as next below "fuel oil," was selected for routine use. When smeared in a thin layer or spread on the surface of water, it is of a very dark-brown color and is quite sticky. Its coefficient of "spread," although considerably less than that of the more expensive fuel oils, is higher than that of the crude oils, and is ample to permit of its use by dripping; the resulting film sticks tightly to ditch banks and is very resistant to evaporation.

To facilitate distribution the oil barrels were stored in small "oil houses" at several points about town. By this procedure a minimum of time and labor was required to replenish drip cans, and the men engaged in hand spraying could avoid carrying full cans for long distances.

Two methods were employed for the application of oil, automatic drip cans (fig. 23) and knapsack pump sprayers (fig. 24). For the former, 5-gallon galvanized-iron cans, equipped with adjustable screw stopcocks and sold by wholesale hardware dealers at 65 cents each, were used, and for the latter the Myer's pump knapsack sprayer with galvanized-iron tank. Stands built of scrub-oak saplings or "cut offs" from the lumber mills were used for the drip cans and were so arranged as to have the drops of oil delivered from an elevation of about 4 feet to some rapidly moving portion of the stream. On each stream of constant flow the cans were spaced about 200 yards apart and so adjusted as to deliver about 15 drops of oil per minute when the contents of the can became warmed during the day. After inspections, drip cans were in a number of instances cut off or removed where no mosquito propagation was observed or where it was found that sufficient oil adhered to the ditch banks to maintain a film.

Larvacide.—In the small runs and ditches in and about the lumber yards where oil could not be employed because of insurance restrictions, mosquito propagation was effectually controlled by the use of an emulsion of a phenol disinfectant compound, a proprietary preparation on sale in the open market at 80 cents per gallon. This compound forms a milky emulsion when mixed with water, and was found

to serve well as a larvacide, killing larvæ and pupæ in about three minutes at a dilution of 1–20.

Cost.—The following summary exhibits the costs of oiling operations:

TABLE 16.—*Costs of oiling operations.*

Oil and larvacide purchased: Oil, f. o. b. Crossett, twenty-seven 50-gallon barrels $168.25, or $0.1246 per gallon. Larvacide, 34 gallons, $27.28, or $0.8023 per gallon.

Oil distribution:	Gallons
Oil applied to "old ditches"	1,035
Oil applied to "new ditches"	70
Oil applied to "street ditches"	258
Total	1,363

Costs of oil and larvacide application:	
2 knapsack sprayers	$14.70
50 drip cans	39.00
49 drip-can stands, construction	9.00
Labor, spraying	238.65
Total	301.45

Inspections.—During the season of active mosquito propagation routine inspections of the territory under observation were made at weekly intervals. For these inspections the town and its environments were divided into four districts and a chart was prepared on which were listed all streams and other known potential breeding places. The first four days of each week were devoted to systematic examination of each of the four districts by the sanitary inspector, whose findings were then recorded upon the chart together with any minor corrective or maintenance measures employed. The remaining two days of the week were utilized for such works as required a gang of laborers, of whom the sanitary inspector then acted as foreman. Supplementary inspections were made at irregular intervals, in addition to surveys for collection of biologic material, determination of mosquito prevalence outside of the controlled zone, and other special purposes.

Monthly malaria morbidity reports.—To follow the monthly incidence of malaria as influenced by the mosquito-control operations, tabular monthly reports were obtained from the chief surgeon of the Crossett Hospital at the end of each month during 1916, giving the name, age, sex, residence, and number of times seen of all cases receiving professional attention for malaria, clinically diagnosed, during the preceding month. From these reports a card index, by months, was made, and the calls and cases, grouped as to sex and color, were recorded on charts. The calls were entered, by corresponding months, on the chart of calls made in 1915 for malaria (see figure already given on p. 31).

These data were also utilized for the preparation of a "spot map" of known cases, each case being entered as reported, for the purpose of studying the distribution of the known cases and ascertaining their relation, if any, to each other. As may be seen from the completed map (map 2), the cases were found to be fairly uniformly distributed in the various parts of town, with about double the number reported for whites as for colored persons (v. tabular summary on p. 28).

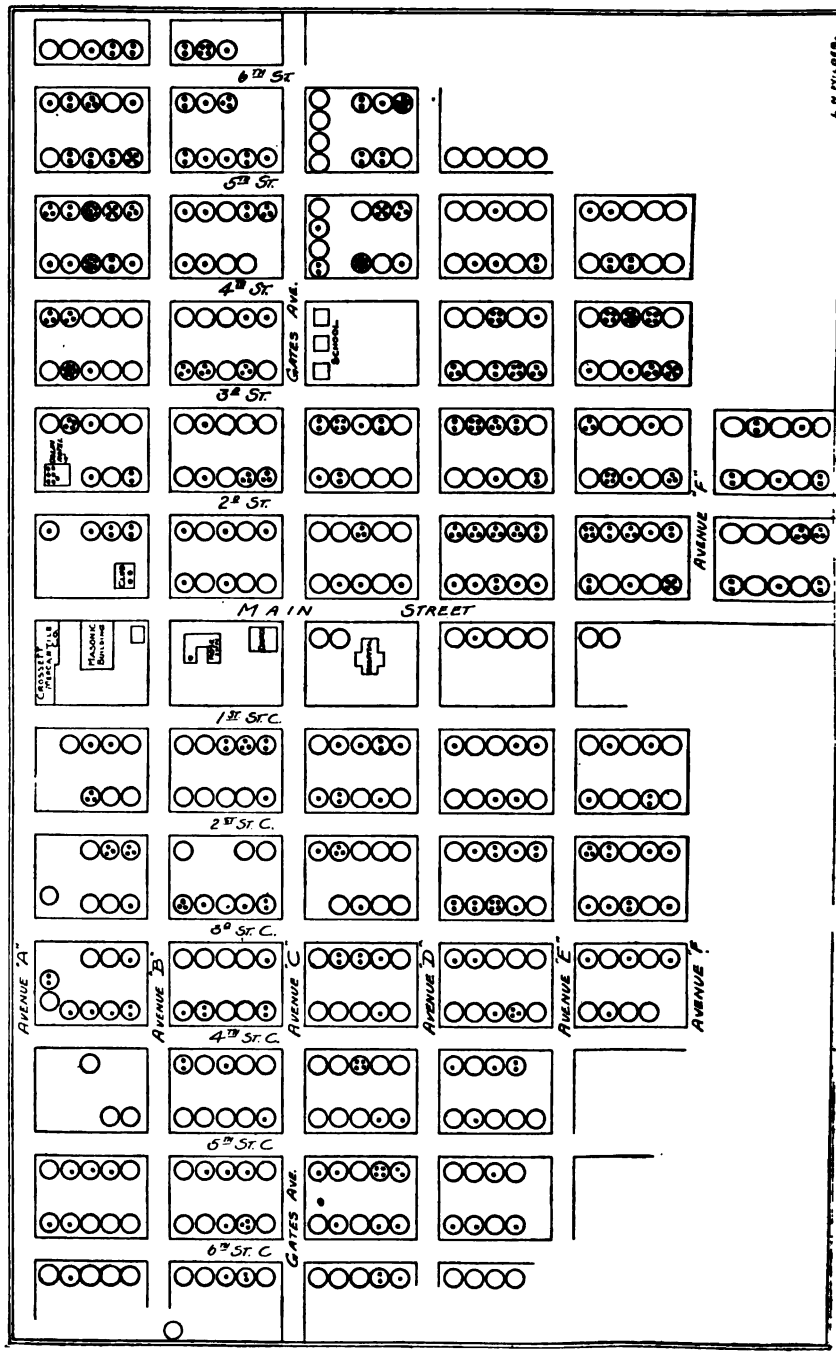
Educational measures.—For the purpose of enlisting the active interest and cooperation of the people, a number of lectures were delivered, usually accompanied by stereopticon illustrations. These were given in churches, schools, and other meeting places to both white and colored people at the beginning of operations and were probably of value in inviting attention to mosquito propagation in artificial containers. It is believed that in Crossett suppression of propagation of mosquitoes of all kinds was responsible for at least as much of the enthusiasm with which the work was popularly received as was malaria control through *Anopheles* elimination.

RESULTS.

The immediate results of the mosquito-control operations begun on April 10 were made evident, first, by an almost complete absence of mosquitoes of all varieties, and, then, beginning in May, by a progressive diminution in the incidence of malaria.

Mosquito prevalence.—The drainage of a number of the nearer wet areas, the clearing of streams and ditches of obstructions, and the filling of pits resulted in the early control of mosquitoes which would have caused the season's first seriously large broods; and as obstructions were removed from some of the town ditches, waters fairly alive with larvæ and pupæ, principally of *Culex*, were disposed of and the ditches allowed to dry. Complete mosquito control was secured at the end of May, and with the exception of a few *Anopheles quadrimaculatus* taken July 5–7, following hard rains, no invasions of more than occasional individual mosquitoes were observed or reported. At the outskirts of the community, however, and at the mills mosquitoes were several times noted during the first half of the summer.

Second parasite index.—A second parasite index was obtained in December to determine the change in endemic infection, the same technique being observed as in the preliminary index (v. p. 15); the findings in the second index are exhibited in the following table:



MAP 2.—Hypothetical, showing human distribution, reported cases of malaria, 1918.

U.S. PUBLIC HEALTH SERVICE

TABLE 17.—*Parasite index—Crossett—December, 1916.*

Age.	Number examined.						Total.
	White.			Colored.			
	Male.	Female.	Total.	Male.	Female.	Total.	
4 to 5				10	5	15	15
6 to 9	55	69	124	36	26	62	186
10 to 14	76	57	133	35	30	65	198
15 to 19	31	33	64	26	10	36	100
20 to 29	20	15	35	20		20	55
30 to 40	5	3	8	11		11	19
Total	187	177	364	138	71	209	573

Age.	Number positive.						Total.	Type.		
	White.			Colored.				Tertian.	Estivo-autumnal.	Total.
	Male.	Female.	Total.	Male.	Female.	Total.				
4 to 5										
6 to 9	2	1	3	2	1	3	6	5	1	6
10 to 14	3	2	5	1		1	6	5	1	6
15 to 19		1	1	1		1	2	2		2
20 to 29										
30 to 40				1		1	1		1	1
Total	5	4	9	5	1	6	15	12	3	15

	Per cent.
Total index	2.61
White index	2.47
Colored index	2.87

The summarized comparative findings obtained in the first parasite index, May, 1916, and the second series of examinations, December, 1916, are given in the following table, which also exhibits the reduction in parasite endemicity:

TABLE 18.—*Comparative findings, first and second indices.*

	White.	Colored.	Total.
	Per cent.	*Per cent.*	*Per cent.*
First index May, 1916	10.95	7.25	9.43
Second index December, 1916	2.47	2.87	2.61
Reduction	77.45	60.42	72.33

Malaria control.—The incidence of malaria in Crossett during 1916 is illustrated in the following charts and tables, prepared from the data reported at monthly intervals from the Crossett Hospital; in these reports are included all professional consultations in which a clinical diagnosis of malaria was made by the physicians of the company, and comprise admissions to hospital, dispensary consultations, and residence visits. In view of the industrial nature of the com-

munity, it is believed that these records represent all but a very small proportion of the total malaria coming under professional notice during the year. Table 19 and Chart 1 are illustrative of the total calls for malaria, for conditions other than malaria, and for all causes, by months, in 1916:

TABLE 19.—*Total calls, by month, 1916, Crossett.*

	For conditions other than malaria.	For malaria.	Total.
January	992	40	1,032
February	510	39	549
March	300	59	359
April	263	81	344
May	188	114	302
June	130	98	228
July	308	95	403
August	511	91	602
September	513	54	567
October	447	46	493
November	313	20	333
December	297	4	301
Total	[1] 4,772	[2] 741	5,513

[1] 86.56 per cent. [2] 13.44 per cent.

In the following tabular summary are shown the reported calls and cases of malaria in detail, by month:

TABLE 20.—*Hospital reports, calls and cases, malaria, 1916.*

Months.	Cases.						Calls.						Total.	
	White.			Colored.			White.			Colored.				
	Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.	Male.	Female.	Total.	Total cases.	Total calls.
January	25	1	26	9	.....	9	30	1	31	9	.....	9	35	40
February	15	6	21	7	.....	7	20	11	31	8	.....	8	28	39
March	20	13	33	10	5	15	33	11	44	10	5	15	48	59
April	23	16	39	9	5	14	41	24	65	10	6	16	53	81
May	39	21	60	19	7	26	48	35	83	24	7	31	86	114
June	32	17	49	10	11	21	50	21	71	14	13	27	70	98
July	33	15	48	4	18	22	52	20	72	6	17	23	70	95
August	19	16	35	13	10	23	34	26	60	17	14	31	58	91
September	14	12	26	4	6	10	22	16	38	4	12	16	36	54
October	8	8	16	11	3	14	17	11	28	15	3	18	30	46
November	6	2	8	3	2	5	9	4	13	4	3	7	13	20
December	3	1	4	.....	.....	.....	3	1	4	.....	.....	.....	4	4
	237	128	365	99	67	166	359	181	540	121	80	201	531	741

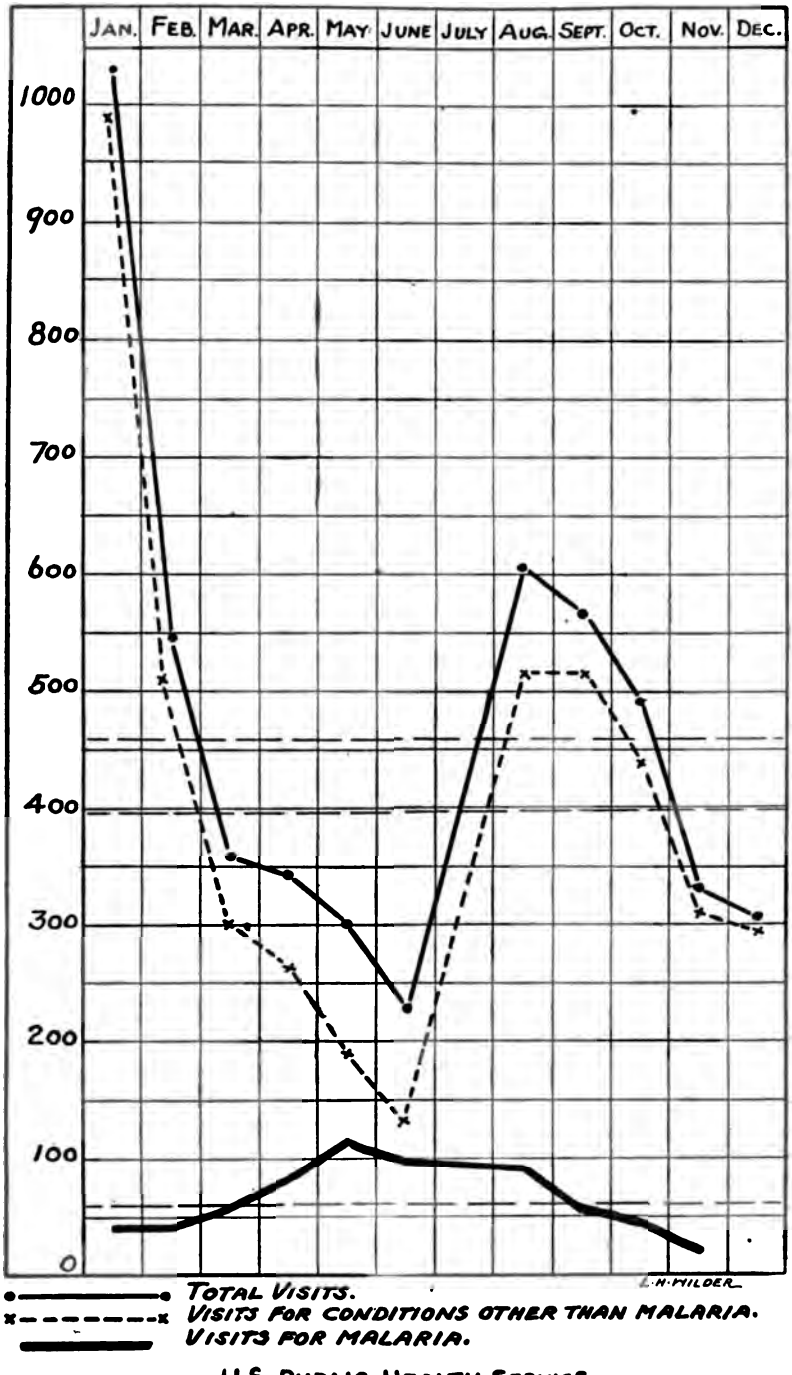


CHART 1.—Total professional visits for malaria and other conditions, Crossett, 1916.

The total calls for 1916 may be compared with those for 1915 as follows (see also chart 2):

TABLE 21.—*Calls for malaria, Crossett, 1915 and 1916.*

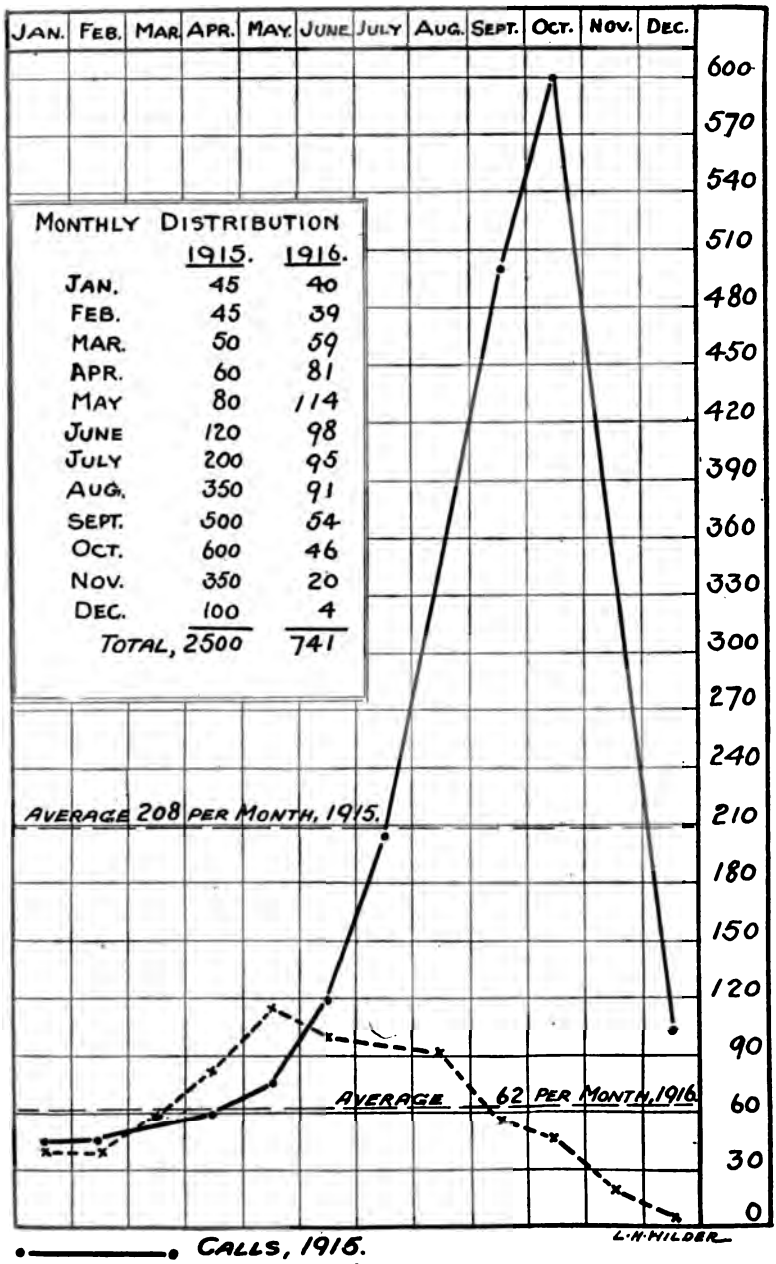
	1915	1916		1915	1916
January	45	40	August	350	[illegible]
February	45	39	September	500	[illegible]
March	50	59	October	600	[illegible]
April	60	81	November	350	[illegible]
May	80	114	December	100	[illegible]
June	120	98			
July	200	95		2,500	[illegible]

From the data graphically shown in charts 2 and 3 it will be observed that in 1916 the greatest incidence of malaria, as represented by the greatest number of cases and calls, was reached during the month of May, and consisted entirely, it is believed, of recrudescences. During May, effective control of mosquito propagation was secured, and it is questionable whether any new infections occurred or chronic cases entered Crossett from elsewhere prior to midsummer. From this "peak" of 86 cases reported for May a gradual decline occurred through the summer and autumn, the period of the year that, in the absence of control operations, should have been marked by a rapid rise in prevalence. The greatest decline was noted in September, at the end of which there were reported 22 cases and 35 calls less than are recorded for the previous month. In October, ordinarily one of the two most highly malarious months of the year in this section, there occurred approximately the same number of cases as were reported at the end of February, viz, 28 and 30 cases, respectively. The professional visits and consultations for malaria totaled in October of 1915 about 600 and in the same month of 1916 but 46, a reduction of approximately 92 per cent.

The net diminution obtained in Crossett as a result of the application of mosquito-control measures may be derived by comparison of the total calls made for this disease in 1915 with those of 1916 as follows:

TABLE 22.—*Diminution resulting from mosquito-control measures.*

	1915	1916	Reduction.
			Per cent.
Total professional visits and consultations for malaria	2,502	741	70.39
Professional visits from June to end of year (eliminating as much as possible the influence of recidives)	2,220	408	81.6



U.S. PUBLIC HEALTH SERVICE

CHART 2.—Calls for malaria, 1915 and 1916, Crossett.

106014°—17——3

Condition of ditches, etc., at end of season.—After the termination of active operations winter surveys were made to ascertain the condition of the several streams and ditches and to what degree reclearing and other work would be required at the beginning of the next year to maintain the control instituted at its highest efficacy. In general, the problem should be much simpler and the necessary costs for labor and other items considerably less, as much of the first work of a more or less permanent character, such as removal of timber, filling of borrow pits, and drainage of wet areas would be obviated. A recleaning at the beginning of the season of the prin-

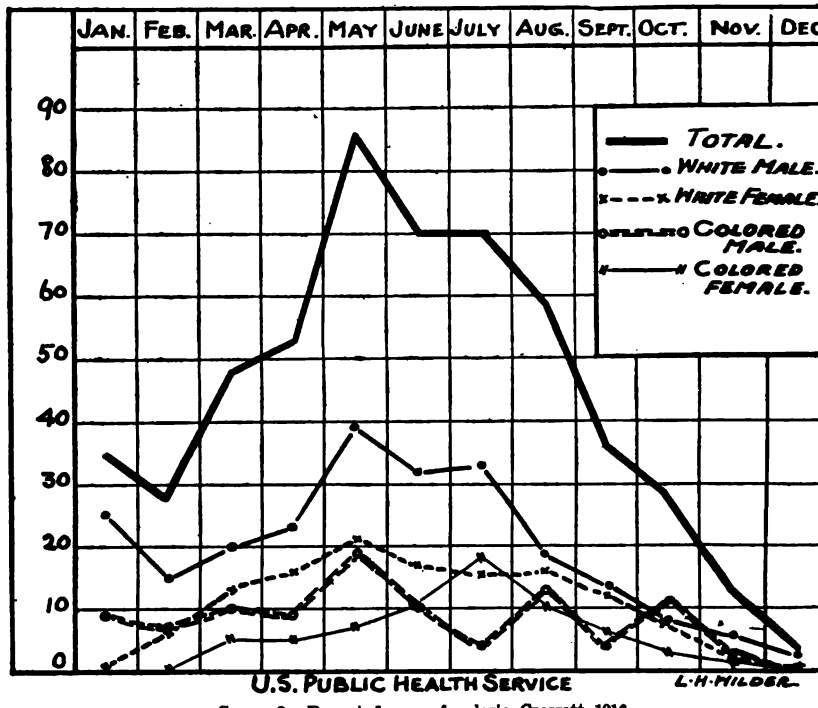


CHART 3.—Reported cases of malaria, Crossett, 1916.

cipal streams and ditches of vegetation and obstructions, the use of oil by knapsack sprayers, and at a few points by drips, and a small amount of maintenance labor during the summer should, with careful systematic inspection, be all that is needed to continue the almost complete freedom of the town from malaria and mosquitoes. In accordance with recommendations embodying the above in detail, the suggested operations for continued control of malaria have been incorporated among the routine civic activities of Crossett.

Costs with reference to control gained and to population influenced.—The cost of the operations at Crossett are exhibited in the table given below, which has been prepared after analysis of the total disburse-

ments, and presents in summary the costs of such items as have direct reference to malaria control. In the preparation of this compilation there have been excluded all costs of administration, supervision (save that of the salary of the sanitary inspector), history, and parasite index determinations, and scientific investigations—activities which, while desirable for the purpose of the present work as an intensive study, bear no essential relation to the effectiveness of the malaria-control demonstration. The following is a summary table of costs:

TABLE 23.—*Costs in summary; Crossett, 1916.*

Salary sanitary inspector, 1 year	$678.83
Labor as follows:	
Ditching old streams	459.00
Ditching new streams	204.10
Ditching street ditches	195.12
Pond clearing	47.50
Maintenance ditches	147.35
Artificial container treatment	14.00
Construction 49 stands for oil drip cans	9.00
Spraying oil	238.69
Amounts expended by railroads for borrow-pit fills, drainage, etc	216.40
Oils and larvacide	195.53
Niter cake, estimated cost of amount used	5.00
Tools, knapsack sprayers (2), drip cans (50)	95.88
Total	2,506.40

The reduction effected in the incidence of malaria in Crossett and the costs thereof with reference to population may be shown in summary as follows:

TABLE 24.—*Reduction in malaria and costs of control measures.*

Total cost malaria-control operations	$2,506.40
Total population (census, April, 1916)	2,029
Per capita cost	$1.23½
Per family cost, average	$5.31
Reduction in incidence of malaria as ascertained by repeated parasite indices—per cent	72.33
Reduction as ascertained by comparison of total calls for malaria in 1915 and 1916—per cent	70.39
Reduction as ascertained by comparison of calls during the active seasons of 1915 and 1916—per cent	82.07

ACKNOWLEDGMENTS.

Appreciative acknowledgment is made of the valued assistance of the citizens of Crossett, the officials of the city, and the officials of the Crossett Lumber Co., whose interest and cooperation contributed substantially to the success of the foregoing work.

THE RURAL UNIT, VICINITY OF LAKE VILLAGE, ARK.

R. C. DERIVAUX and T. D. HAAS.

GENERAL DESCRIPTION.

The locality selected for the demonstration studies in malaria prevention through the use of screening and quinine under rural conditions is situated in the alluvial lands of Chicot County, southeastern Arkansas, and consists of a group of 10 plantations lying close to Lake Chicot and Yellow Bayou, in the vicinity of the town of Lake Village. Conditions are representative of what is found in the more malarious sections of the South with reference to economics, population, and health.

Topographically, the country is flat, and has a mean elevation of about 126 to 130 feet above sea level. The less elevated portions consist largely of what is locally known as "bottom" or "swamp," and are, in the main, as yet uncleared, save that the more accessible of the plentiful timber is steadily being removed; in these swamps, the water table is very close to the surface of the ground, water accumulates in the sloughs and "breaks," and vegetation is prolific, the dense growth of underbrush being almost tropical in its luxuriance.

The soil consists of dark-brown loam and "buckshot" in the lower sections, heavy in texture and more or less impervious because of "silting" from the overflows of the Arkansas and Mississippi Rivers to which the region has been repeatedly subjected. In the higher sections, not usually inundated, the soil is of a lighter reddish-brown color, in places sandy, and is much more pervious. The cultivated land is fairly easily worked and is of a high grade of fertility. Cotton is the chief product; corn, oats, hay, etc., are raised to a lesser extent, and many of the plantation tenants, more especially the Italians, maintain gardens near their homes to supply their tables.

Opportunities for mosquito propagation are abundant (figs. 25–26). The numerous surface collections of water, swamp edge pools, ditches, and "borrow-pits" along the railroad rights of way (in addition to the many artificial containers on premises), provide plentiful facilities for breeding. During dry periods, however, many of the temporary propagation places disappear, with noticeable effect on mosquito prevalence.

Economic and sanitary conditions vary widely among the various groups of plantation residents, and bear an important relation to

FIG. 25.—BORROW PIT, ROADSIDE.

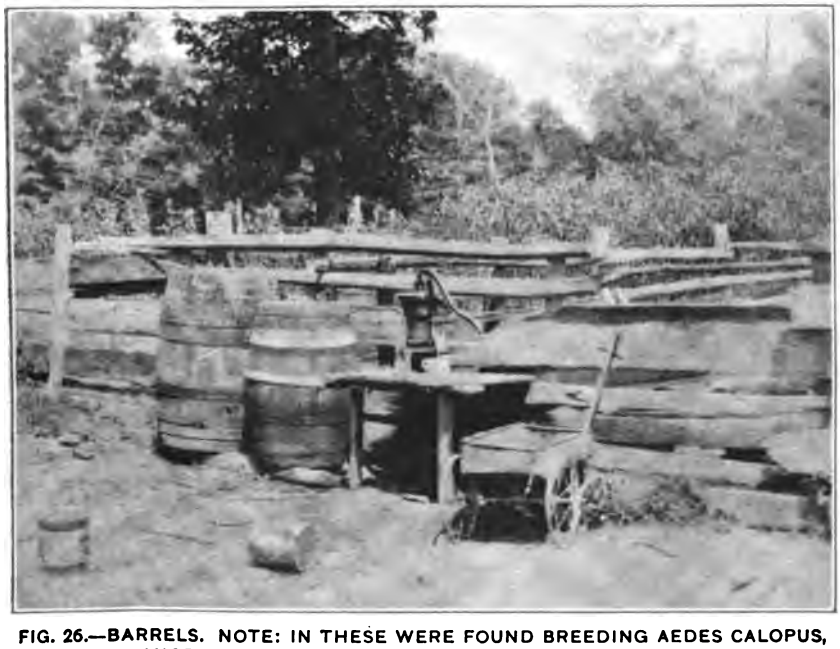


FIG. 26.—BARRELS. NOTE: IN THESE WERE FOUND BREEDING AEDES CALOPUS, ANOPHELES PUNCTIPENNIS, AND A VARIETY OF CULEX.

FIG. 27.—TYPE OF DOOR SCREENING INSTALLED, HOUSES OF GROUPS "A" AND "C."

FIG. 28.—TYPE OF WINDOW SCREENING INSTALLED, HOUSES OF GROUPS "A" AND "C."

FIG. 29.—TYPE OF TENANT HOUSE TOO COMMONLY FOUND.

FIG. 30.—TYPE OF TENANT HOUSE RENDERING DIFFICULT ANTIMALARIA MEASURES.

FIG. 31.—TENANT HOUSE, A STRUCTURAL DETAIL.

FIG. 32.—CHIMNEY PROTECTION, RURAL UNIT.

he prophylaxis of malaria. The houses of managers and owners re of a better class of construction, and while not perfectly screened, re much better protected against mosquito invasion than are those f the tenants or "hands." This latter group, comprising both whites nd colored, is almost totally unprotected and represents the class n which the ravages of chronic malaria are more prominently nanifested.

Most of the tenant houses (figs. 29–31) are single-story, shingle-oofed frame structures, with mud-and-stick or brick chimneys, and lmost all present the appearance of having been built a number of ears ago. The usual type of construction is that of a low building, ontaining a single large room, or two small rooms, with a "lean-to" t the rear, serving as dining room and kitchen. The floors of most re elevated above the ground from 1 to 4 feet, the sills of the floor-ng resting on upended blocks or sections of logs. The flooring proper s in some instances of "tongue-and-groove" material, in which ases if the wood is free of knot holes mosquito entry is effectually revented as long as the wood remains sound. In the majority of abins, the floors are laid with ordinary planks, the apertures along he edges, even in recently installed floors being occasionally as much as 2 inches, and commonly, from one-fourth to one-half inch. The iding of the houses is ordinarily of 1 by 6 inch planks, with strips nailed over the seams on the outside; in time these become detached and leave cracks through which the wind, rain, and mosquitoes enter freely, unless "chinking" with cotton or mud or papering is resorted to. Many of the more enterprising tenants line the interiors of their houses with paper, either torn from the pages of a mail-order catalogue or taken from magazines and newspapers. The number of occupants of these houses varies between 2 and 15, and evidences of crowding are common. Cooking is done either on stoves or on the open hearth. A distinctive feature of the houses of Italian farmers is the large baked-mud ovens in the yards.

Sanitary arrangements are, in general, crude. The water supply is generally obtained from bored wells, 15 to 30 feet in depth. A supply is taken directly from Lake Chicot by many of the families living along its shores. No toilet facilities other than surface latrines were noted, practically all of these being of the open or "E" type; many of the tenant houses had no toilet provision whatever.

PRELIMINARY OPERATIONS.

Sanitary census and history index of malaria.—As active operations were undertaken in each unit, a systematic survey was made, maps were prepared, and a census was taken to ascertain general sanitary conditions and to determine the history index of malaria.

Summaries illustrating the extent of operations and presenting the more important data obtained in connection with the census are given in the following tables:

TABLE 25.—*Sanitary data obtained from census.*

	Population.		
	White.	Colored.	Both.
Number of plantations in controlled units			[illegible]
Total area of controlled plantations.....acres			4,540
Population	91	349	440
Number of houses	19	84	103
Number of families	19	87	106
Average number of rooms per house	3	3.1	3.1
Average number of occupants per house	4.8	4	4.2
Average length of occupancy.....years	2.9	3.25	3.1
Number of—			
Outbuildings	43	90	133
Chicken yards			5
Privies	12	31	43
Percentage of houses having privies	63.1	36.9	41.7
Windows			453
Number of windows per house			4.3
Doors			330
Number of doors per house			3
Stables	24	37	61

TABLE 26.—*History index of malaria.*

	Number.	Giving positive histories of previous malaria.	History index.
White and colored population:			*Per cent.*
Total	440	274	62.3
Males over 15	145	92	63.4
Females over 15	142	98	69.0
Males under 15	82	43	52.4
Females under 15	71	41	57.7
White population:			
Total	91	60	65.9
Males over 15	29	20	68.9
Females over 15	25	18	72.0
Males under 15	24	15	62.5
Females under 15	13	7	53.8
Colored population:			
Total	349	214	61.3
Males over 15	116	72	62.0
Females over 15	117	70	59.8
Males under 15	58	28	48.2
Females under 15	58	34	58.6

First parasite index and spleen index of endemic infection.—At the time of taking of the sanitary census thick blood smears were obtained from almost all of the residents of the several plantations to determine the parasite index prior to control operations, and manual examinations were made of all under 16 years of age to ascertain the index of splenic enlargement. The technique observed in connection with the blood-smear examinations was that described by

Von Ezdorf,[1] and splenic enlargement was determined by palpation, usually in the prone position and with the abdomen exposed.

The findings obtained in the first parasite index and the spleen index, April–May, 1916, are presented in the following tables:

TABLE 27.—*Parasite index—Rural unit—April–May, 1916.*[2]

Age.	Number examined.						
	White.			Colored.			Total.
	Male.	Female.	Total.	Male.	Female.	Total.	
1	1		1	2		2	3
2 to 3	4	1	5	8	14	22	27
4 to 5	3	2	5	11	3	14	19
6 to 9	6	6	12	15	15	30	42
10 to 14	3	5	8	19	17	36	44
15 to 19	7	5	12	20	25	45	57
20 to 29	5	5	10	24	30	54	64
30 to 39	9	5	14	24	25	49	63
40 and up	8	4	12	55	44	99	111
Total	46	33	79	178	173	351	430

Age.	Number positive.							Type.		
	White.			Colored.			Total.	Tertian.	Estivo-autumnal.	Total.
	Male.	Female.	Total.	Male.	Female.	Total.				
1										
2 to 3				1	4	5	5	5		5
4 to 5				3		3	3	3		3
6 to 9	2		2	7	1	8	10	10		10
10 to 14		2	2	2	1	3	5	4	1	5
15 to 19	1		1	4	3	7	8	7	1	8
20 to 29	1	1	2	6	8	14	16	9	7	16
30 to 39	1	1	2	4	1	5	7	4	3	7
40 and up	2		2	9	4	13	15	12	3	15
Total	7	4	11	36	22	58	69	54	15	69

	Per cent.
White index	13.92
Colored index	16.52
Total index	16.04

TABLE 28.—*Spleen index, April–May, 1916.*

	Number examined.	Positive.	Spleen index.
			Per cent.
White	31	2	6.45
Colored	110	2	1.8
Total	141	4	2.8

[1] Von Ezdorf, R. H., "Malarial Index Work," reprint No. 159, Public Health Reports, Dec. 26, 1914, Washington.

[2] No specimens were obtained from 10 residents, 3 of these being recorded as unequivocal refusals, the remaining 7 not being found.

It is of interest to note here the proportionate relations of the history, spleen, and parasite indices in the groups of individuals less than 16 years of age in which the three determinations were made and are available for comparison:

TABLE 29.—*Comparison of history, parasite, and spleen indices.*

	Number examined.	Number positive.	Index.
			Per cent.
History index (under 15)	153	84	54.9
Parasite index (under 14)	135	23	17.0
Spleen index (under 16)	141	4	2.8

From the foregoing it would appear that the true endemic index of malaria, which probably lies between the extremes of the history and parasite indices in this section, is in no way represented by the spleen index. This is believed to be due to the almost universal, although indiscriminate, use of quinine and quinine containing nostrums—a condition which does not obtain among the indigenous peoples of India, Africa, and other tropical places.

THE "NEGATIVE" CONTROL GROUP.

With a view of conducting parallel check observations, an additional group of families living under similar conditions on two near-by plantations, uninfluenced by preventive operations, were observed in the same manner with reference to sanitary conditions, parasite index, and sickness incidence, as were those where prophylactic measures were in effect.

A summary exhibiting the data elicited in the sanitary census of the negative control group is given in the following table:

Number of plantations in the negative control group	2
Total population (all colored)	120
Total number of houses	27
Total number of families	27
Average number of rooms per house	3.1
Average number of occupants per house	4.4
Average length of occupancy ..... years	3.25
Number of houses having privies (59.2 per cent)	16

TABLE 30.—*First parasite index, negative control.*

Age.	Number examined, colored.			Number infected, colored.			Type of infection.		
	Male.	Female.	Total.	Male.	Female.	Total.	Tertian.	Estivo-autumnal.	Total.
o 3	3	4	7	1	4	5	4	1	5
o 5	4	1	5	1	1	2	1	1	2
o 9	9	5	14	1	1	2	1	1	2
to 14	8	10	18	1	3	4	3	1	4
to 19	7	8	15	.....	.....	.....	.....	.....	.....
to 29	6	10	16	.....	4	4	3	1	4
to 39	9	7	16	1	1	2	1	1	2
and up	11	17	28	3	4	7	3	4	7
Total	57	62	119	8	18	26	16	10	26
rcentage	.....	.....	.....	14.03	29.03	21.84	.....	.....	.....

CONTROL OPERATIONS.

As indicated in the introduction, the measures used for the prevention of malaria in connection with the rural studies comprised mechanical protection against mosquitoes through the use of carefully applied screens and the use of quinine administered in "immunizing" doses. Both methods were supplemented by the intensive treatment of carriers with quinine in "sterilizing" doses, upon detection by microscopic examination of the blood.

For the purposes of the present studies, the 106 families under observation were divided into three series or groups, with reference to the control measures applied to them or to their houses, as follows:

Group A, screen group: In this series protection was made available through the use of carefully applied screening. Quinine was administered to proven carriers only.

Group B, quinine group: In this series protection was made available through the use of quinine in "immunizing" doses to all occupants of unscreened houses, together with its administration in "sterilizing" doses to proven carriers.

Group C, combined screen and quinine group: In this series protection was made available through the use of screening and the use of quinine in "immunizing" doses to all occupants during the first half of the summer. Proven carriers received intensive treatment. This group was merged into the first (Group A) on August 1, 1916.

The number of houses, families, and individuals included in control operations in the several groups as described above may be summarized as follows:

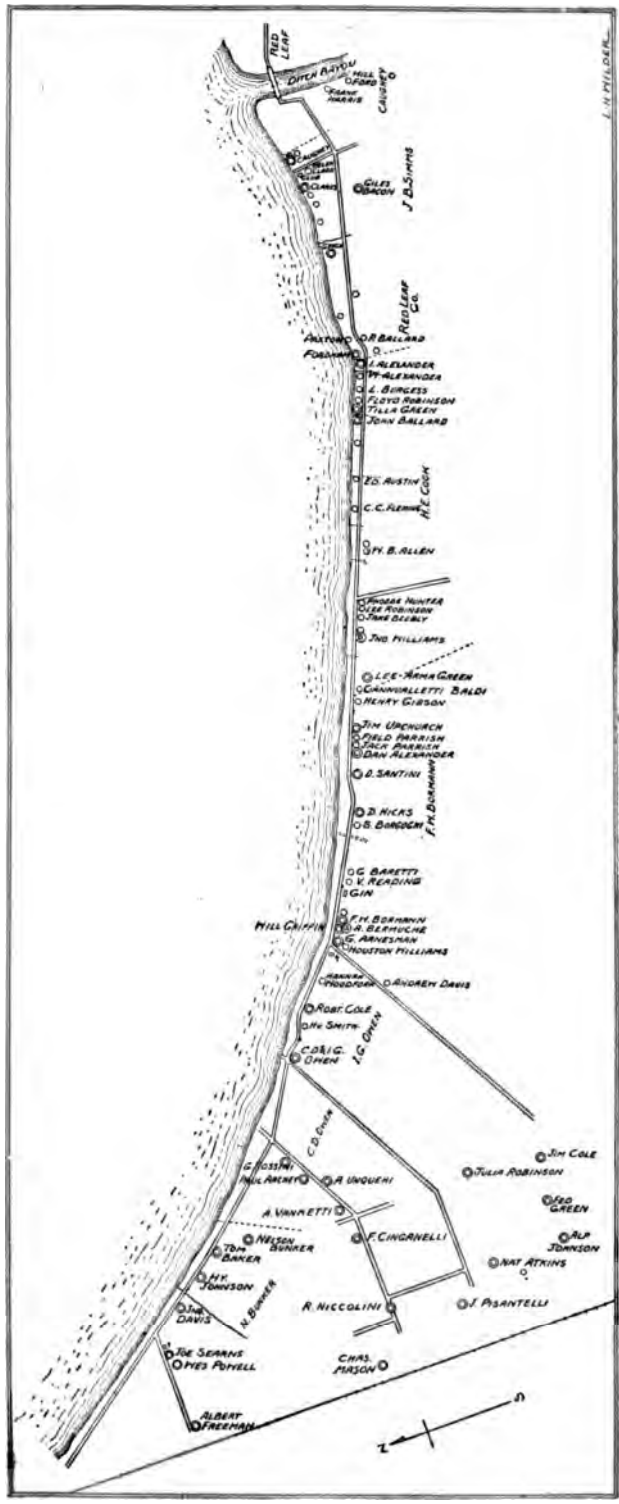
TABLE 31.—*Number of houses, families, and persons included in control operations*

	Houses.	Families.	Persons.
Group "A," screen control (including 5 imperfectly screened managers' houses)	32	32	[illegible]
Group "B," quinine control	65	68	[illegible]
Group "C," combined screen and quinine control	6	6	[illegible]
Total	103	106	[illegible]

As may be noted from the accompanying maps (Nos. 3 and 4), the houses included in the several groups are distributed over a wide area, no effort being made to restrict any group to any given section. In addition, a small number of the families selected for control under group "B" (quinine), are located far removed from either of the larger territories of operations; this disposition was made to avoid the possible influence of contiguity with areas in which opportunities for mosquito infection would be presumably diminished by reduction in number of infected persons.

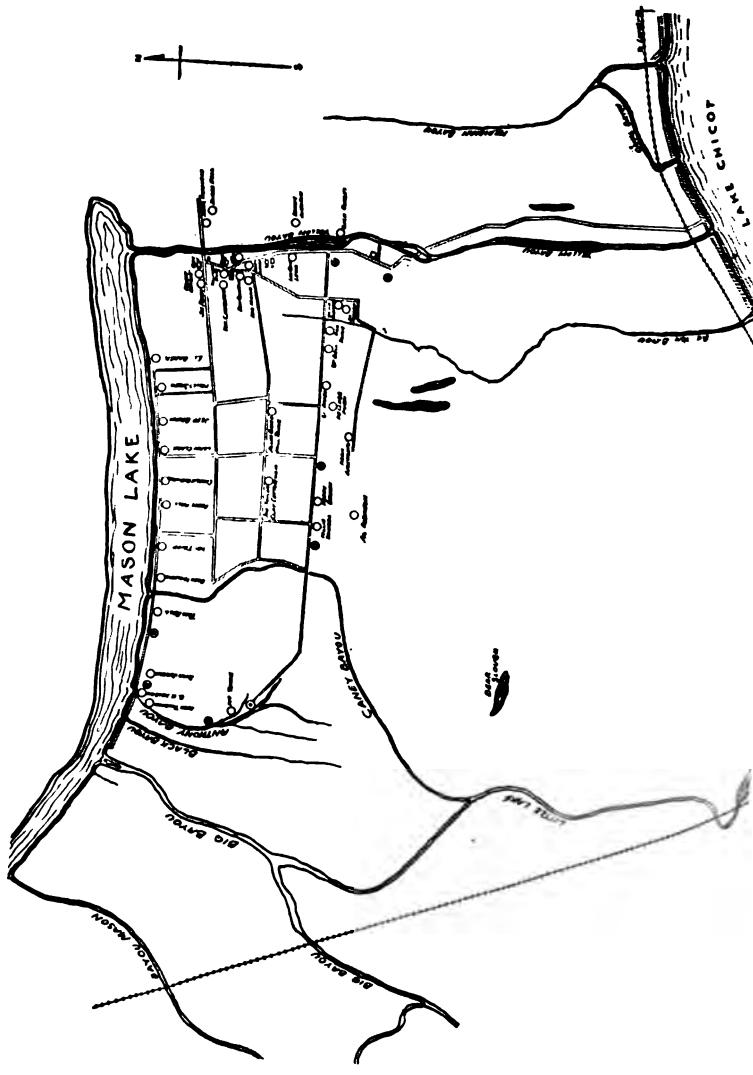
Screening.—As indicated in the summary, systematic observations were conducted with reference to the efficacy of house screening as a control measure for malaria in two groups of 32 and 6 houses, respectively, influencing a total personnel of 173 individuals. For these series there were selected five houses occupied by managers and owners and 33 additional houses which permitted of screening because of the absence of such structural peculiarities as would render the cost prohibitive. To secure data in this particular a test was made of two houses in obviously defective condition.

The installation of the screening of the 33 houses was performed by two sets of workmen, a carpenter and helper. In each case the necessary material had been previously delivered at each house. After inspection and preparation of estimates the only time lost was that required for transportation from one point to the next. In the "Cost summaries" this time has been equally divided and charged throughout as "labor." The material used was 16-mesh galvanized-iron wire cloth, purchased in rolls. A trial was made of a cheaper cotton cloth substitute in three instances, but as it was found totally unsatisfactory it was later replaced by galvanized-iron screen. All door frames were made of seasoned pine lumber and were built on the premises, as few doors were found alike in size and shape. In the case of windows the screen was tacked directly over the frame and secured with "beading." (Figs. 27 and 28.) All chimneys were



MAP 3.—Plantations in vicinity of Lake Village, Ark. Antimalarial operations, 1916. Houses indicated by double rings, thus ◎, are screened.

"capped" with screen held in place by frames, (fig. 32) and where necessary apertures in walls, roofs, or floors were closed by patching with lath, sheet tin, or sheathing paper.



MAP 4.—Yellow Bayou plantation; portion included in antimalarial operations, 1916.

The following table exhibits in detail the cost of materials and installation of screening for the 33 houses screened in connection with these studies:

TABLE 32.—*Distribution of screening cost for 56 houses.*

House No.	Number of rooms.	Places screened.			Cost of materials.							Cost of labor.			Total cost.
		Windows.	Doors.	Chimneys.	Screen.[1]	Lumber.	Paper.	Tin.	Door sets.	Nails.	Total.	Hours.	Rate per hour.	Cost.	
1	4	7	3	1	$4.52	$2.15	.....	.....	$0.65	$0.25	$7.57	22	$0.50	$11.00	$18.57
2	3	7	2	1	3.44	2.15	.....	.....	.40	.20	6.19	12	.50	6.00	12.19
3	2	5	2	1	2.90	2.15	.....	.....	.40	.20	5.65	17	.50	8.50	14.15
4	2	5	2	1	2.90	2.15	.....	.....	.40	.20	5.65	17	.50	8.50	14.15
5	1	2	2	0	1.55	2.15	.....	.....	.40	.20	4.30	17	.50	8.50	12.80
6	2	2	3	1	2.63	2.15	.....	$1.00	.65	.20	6.63	15 1	.50 .40	7.90	14.53
7	1	1	2	1	1.28	2.65	$0.50	1.00	.40	.20	6.03	24	.50	12.00	18.03
8	2	2	2	0	1.55	2.65	.50	.....	.40	.30	5.40	28	.50	14.00	19.40
9	1	2	2	1	2.46	2.40	.....	.....	.40	.20	5.46	18	.40	[2] 7.85	13.31
10	1	1	3	1	1.10	2.45	.....	.....	.65	.20	4.40	14	.50	7.00	11.40
11	3	5	3	1	3.17	2.90	.....	.....	.65	.20	6.92	18	.50	9.00	15.92
12	1	3	2	1	1.91	2.15	.....	.....	.50	.20	4.76	10	.40	4.00	8.76
13	1	3	2	1	1.91	2.15	.....	.....	.50	.20	4.76	10	.40	4.00	8.76
14	1	3	2	1	1.91	2.15	.....	.....	.50	.20	4.76	10	.40	4.00	8.76
15	1	2	2	1	1.66	4.90	.....	.....	.40	.20	7.16	11 10	.40 .25	6.90	14.06
16	2	2	4	1	2.66	4.90	.....	.....	.90	.20	8.66	26	.40	10.40	19.06
17	2	2	4	1	2.66	4.90	.....	.....	.90	.20	8.66	22	.40	8.80	17.46
18	2	4	4	1	3.86	4.90	.....	.....	.90	.20	9.86	24	.40	9.60	19.46
19	1	2	3	1	2.36	1.95	.....	.....	.65	.20	5.16	16	.40	6.40	11.56
20	1	3	2	1	2.09	1.20	.....	.....	.40	.20	3.89	12	.40	4.80	8.69
21	1	3	3	1	2.36	2.40	.....	.....	.65	.20	5.61	13	.40	5.20	10.81
22	1	3	2	1	1.82	.40	.....	.....	.40	.20	3.82	10	.40	4.00	7.82
23	2	4	4	1	3.44	2.40	.....	.....	.90	.20	6.94	19	.40	7.60	14.54
24	2	4	4	1	3.98	2.79	.....	.....	.90	.20	7.87	20	.50	10.00	17.87
25	1	2	2	1	1.82	2.44	.....	.....	.40	.20	4.86	14	.50	7.00	11.86
26	1	2	2	1	1.82	3.11	.50	.....	.40	.20	6.03	.....	.....	8.50	14.53
27	2	4	4	1	3.99	3.90	.50	.....	.90	.20	9.48	24	.50	12.00	21.48
28	3	4	5	2	3.98	3.40	.....	.....	1.15	.20	8.73	25	.50	12.50	21.23
29	1	2	2	1	1.05	2.40	.....	.....	.40	.20	4.05	13	.50	6.50	10.55
30	2	4	4	1	1.43	2.90	.....	.....	.90	.20	5.43	25	.50	12.50	17.93
31	1	2	2	1	1.41	1.90	.....	.....	.50	.20	4.01	20	.40	8.00	12.01
32	2	4	4	1	3.16	2.80	.....	.....	.90	.20	7.06	20	.40	8.00	15.06
33	3	7	3	1	3.16	1.90	.....	.....	.65	.20	5.91	17	.40	6.80	12.71
Total	56	108	92	32	81.93	88.89	2.00	2.00	21.10	6.75	201.67	.....	.....	267.75	469.42
Average cost	.....	.....	.....	.....	2.48	2.81			.61	.20	6.11	.....	.....	8.11	14.22

[1] The cost of galvanized-iron screen is uniformly charged at $3 per 100 square feet.

[2] $0.65 extra time.

Quinine prophylaxis.—Quinine was used for two purposes in connection with these studies, "immunization" (i. e., to prevent the development of infection), and "sterilization" (i. e., to eliminate carriers by destruction of sexual forms of parasites).

Quinine was issued for administration in "immunizing" doses to the members of the 68 families included in group "B," beginning with the organization of the group and ending November 1, 1916. Two forms of the drug were dispensed—3 and 5 grain capsules of quinine sulphate, and an emulsion of quinine sulphate in chocolate, containing 2 grains to each dram. The method of administration was as follows: For adults, two doses of 5 grains each, to be taken in the morning and evening of two successive days each week, preferably, on Saturday and Sunday, making a total of 20 grains per week; for individuals less than 15 years of age the dosage was reckoned at 1 grain for each three years, children less than nine years receiving the emulsion, as did also a few older persons who "couldn't swallow capsules." In each case the method of administration was carefully explained either to the individual or, in the case of children, to older members of the family. Each member of every family received an individual issue of quinine, plainly marked with name and directions, usually 32 capsules—a seven weeks' supply—of which record was kept at subsequent inspections.

For sterilization, quinine was issued to all individuals in the three groups in whom parasites were demonstrated upon microscopic examination of the blood in connection with the first parasite index. Adults were given 10 grains daily, in two doses of one 5-grain capsule each for 30 consecutive days; children received proportionate dosages, two a day for the same period. Each carrier received an individual issue of quinine sufficient to last two weeks, and record was kept of it. No reexaminations were made upon completion of treatment, determination of the sterilization being provided for in repetition of the general parasite index.

Inspections and surveys.—Systematic inspections of the entire territory under observation were conducted by the sanitary inspector until the termination of active operations on November 1, 1916; following this, further inspections were continued at irregular intervals during the winter, as road and other conditions permitted.

In the course of inspections, each house or family was visited at least once in each week, and record was made of the following conditions: The taking of or failure to take quinine as recommended; the condition of screening material and its efficacy; incidence of illness and its nature; cost of medical attention and medicine, if any; the amount of time lost. In all cases in which a suspicion of malaria existed a report was made to the field director, and the blood was examined for parasites.

At intervals of two weeks a mosquito survey of all premises was conducted and a "hand catch" made in the buildings of the controlled groups. to ascertain the variation in Anopheles incidence, to determine the degree of infestation of dwellings, and to check up the efficacy of screening measures. Conditions in the various breeding places of mosquitoes were also observed, and collections of larvæ and other biologic material were made from time to time to obtain data as to mosquito production.

Educational measures.—Detailed explanation of the various phases of the operations and their purpose was made to almost all adult members of the groups of individuals concerned, to enlist their interest and active cooperation, and during the early part of the summer supplementary lectures with projectoscope illustrations were delivered in churches and other meeting places. These lectures were well attended and, it is believed, were productive of much good.

RESULTS.

In general, malaria and other illness, with attendant economic loss, have been markedly less on the plantations under control than in the negative group and in the adjacent country where no prophylactic measures were in use, and the managers of the former have expressed themselves to the effect that health conditions among their tenants have been much improved. In other sections of Chicot and in the adjacent counties malaria has prevailed in 1916 to about its usual degree, although but few cases of unusual severity have been seen; four cases of hemoglobinuric fever are recorded as having occurred between July 1 and November 1, not far from Lake Village.

Anopheles prevalence.—In connection with routine mosquito surveys, *Anopheles quadrimaculatus* was constantly taken, and in the past summer it has been the only species present in sufficient numbers to have been of sanitary importance. This anopheline was found present in varying numbers in and about all dwellings and other buildings and was repeatedly reared from larvæ taken from the more important breeding places of the territory. In April, 1916, a single example of *Anopheles crucians* was captured on a gallery, and during the summer one *Anopheles punctipennis* was taken from an outbuilding. These, with two additional *Anopheles punctipennis* bred from larvæ, were the only anophelines other than *A. quadrimaculatus* noted during the year's work.

In the screened group ("A") a total of 52 *Anopheles quadrimaculatus* was taken in the 38 houses systematically examined between June and the end of November, although this species was constantly present in the outhouses, privies, and stables; in the unscreened group ("B") the species was captured regularly from dwellings and

the other buildings in about the same numbers, an average of between five and six at each inspection being the usual capture.

To determine more specifically the results obtained and the degree of malaria control effected following the use of the different measures, a second parasite index was made of the entire series, including the negative control group, in December, 1916; from this reexamination, together with tabulation and analysis of the data obtained in connection with inspections and blood examinations of reported cases of illness, have been determined the several results.

Second parasite indices.—The technique observed in preparation of the second indices was the same as that used at the beginning of the work, and effort was made to reexamine the individuals who were included in the first index and remained in the units; in these general indices, however, are included a few newcomers, partially replacing the number that moved to other places or were repeatedly missed at their homes.

TABLE 33.—*Second parasite index, protected groups "A" and "B," December, 1916*

Age.	Number examined.						Total.
	White.			Colored.			
	Male.	Female.	Total.	Male.	Female.	Total.	
1				1		1	1
2 to 3	4	2	6	10	10	20	2
4 to 5	3	2	5	12	4	16	2
6 to 9	8	6	14	14	10	24	3
10 to 14	2	6	8	20	22	42	5
15 to 19	7	4	11	10	22	32	4
20 to 29	5	4	9	22	25	47	5
30 to 39	6	5	11	21	29	50	6
40	6	2	8	48	42	90	9
Total	41	31	72	158	164	322	39

Age.	Number positive.						Total.	Type.		Total.
	White.			Colored.						
	Male.	Female.	Total.	Male.	Female.	Total.		Tertian.	Estivo-autumnal.	
6 to 9		1	1	2		2	3	2	1	3
10 to 14				2	1	3	3	2	1	3
15 to 19	2		2		1	1	3	2	1	3
20 to 29				1	1	2	2	2		2
30 to 39				1	3	4	4	4		4
40				5	2	7	7	4	3	7
Total	2	1	3	11	8	19	22	16	6	22

	Per cent.
White parasite index	4.17
Colored parasite index	5.59
Total parasite index	5.28

TABLE 34.—*Second parasite index negative control, colored, December, 1916.*

Age.	Number examined (colored).		Total.	Number positive (colored).		Total.	Types.		Total.
	Male.	Female.		Male.	Female.		Tertian.	Estivo-autumnal.	
to 3	2	4	6	.....	2	2	1	1	2
to 5	1	2	3	.....	.....	.....	.....	.....	.....
to 9	10	8	18	3	2	5	4	1	5
0 to 14	8	11	19	2	1	3	3	.....	3
5 to 19	5	3	8	3	.....	3	2	1	3
0 to 29	4	7	11	.....	1	1	1	.....	1
0 to 39	5	7	12	1	1	2	2	.....	2
0	13	14	27	2	2	4	3	1	4
Total	48	56	104	11	9	20	16	4	20
Percentage	.....	.....	.....	.....	.....	19.23	80	20	.....

Total parasite index, 19.23 per cent.

Summarizing the parasite indices begun in May, at the beginning of work, and December, at its termination, in the controlled groups "A" and "B," parallel with those of the "Negative" group, the following table is obtained which illustrates the reduction in endemicity:

TABLE 35.—*Comparison of first and second indexes.*

	The controlled groups "A" and "B."			The negative group, colored.
	White.	Colored.	Total.	
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
First index, May, 1916	13.92	16.53	16.04	21.84
Second index, December, 1916	4.16	5.90	5.58	19.23
Reduction	70.12	64.42	65.22	11.95

The efficacy of screening operations, group "A."—On all of the 38 houses included in group "A," 33 of which were especially screened in connection with these studies, the materials used maintained their original efficiency throughout the period during which observations were conducted, and required but a negligible amount of minor repair, despite hard usage under difficult conditions. No replacement of screen was found necessary, save in the referred-to instance of three houses experimentally screened with a cotton substitute for wire screening material. Because of rotting, and shrinkage following wetting by rains, tears and rips developed in this material, which so diminished its effectiveness as to necessitate replacing by galvanized-iron screen, after a service of three months (June 1 to Sept. 1). The other minor repairs included patching of tears in a few instances, caused by careless moving of furniture, and straightening of three doors warped by rain.

The costs of the foregoing are given in the following table:

TABLE 36.—*Cost of replacement of cloth screening material by galvanized-iron wire.*

House No.	Cost of materials.			Cost of labor.			Total cost.
	Screen.	Nails.	Total.	Hours.	Rate per hour.	Cost.	
28	$1.47	$0.15	$1.62	3	$0.25	$0.75	$2.37
29	1.68	.15	1.83	4	.25	1.00	2.83
30	3.55	.20	3.75	5	.25	1.25	5.00

TABLE 37.—*Repairs to screened houses involving no replacement of materials.*

House No.	Labor.	Amount.
6	1 hour, at 25 cents	$0.25
8	do	.25
11	do	.25
13	do	.25
16	do	.25
17	do	.25
28	do	.25
33	do	.25
Total		2.00

Of the 173 individuals in the combined "A" and "C" groups at the beginning of operations, 142 were included in both parasite indexes.[1] The following table exhibits the comparative parasite findings of these individuals before and after the active malaria season.

TABLE 38.—*Malaria control, screen group.*

	Number examined.	Number positive.	Index.
			Per cent.
First index, May, 1916	142	17	11.97
Second index, December, 1916	142	5	3.52
Reduction			70.6

Use and efficacy of quinine, group "B."—The issue of quinine was begun in connection with these studies on June 1, 1916. As stated in the summary on page 39 the drug was issued for sterilization to all proven carriers, to all members of group "B" (the quinine group), and to all members of group "C" (combined group, later merged into "A") during the months of June and July. The numbers of individuals receiving quinine are shown in the following table:

[1] In this and subsequent specific summaries taken from the general indexes, only those individuals have been included whose residence in their respective groups has been continuous and who have been examined in both the first and second series of examinations.

TABLE 39.—*Number of persons receiving quinine.*

	Total personnel.	Number receiving quinine for sterilization.	Number receiving quinine for immunization.
Group "A"	150	16	.....
Group "B"	267	52	215
Group "C"	23	1	22
Total	440	69	237
Received quinine, total	.....	.....	306

Of the total of 306 to whom quinine was issued, accurate records are available for 60 of the proven carriers and 195 of those receiving the drug for immunization alone, a total of 255; the remaining 51 of the original total personnel are not included in further tabulations, having moved to other plantations or died (1, uremia), or because of incomplete data (10).

Because of the superstitious ignorance of plantation negroes as a class, it was not without the usual difficulty that the routine use of quinine was obtained; by a few the drug was thrown away or used as a medium of barter, and by others taken as a medicine for every conceivable condition other than or besides that for which it was recommended. By dint of repeated visits, however, and, as no ill effects were noticed, its fairly general use was obtained.

The degree of regularity with which the issued quinine was used is illustrated in the following tables, taken from the summarized quinine records. In these are shown the proportionate amounts of quinine taken by 255 individuals, to 195 of whom it was issued for purposes of immunization (174 in group "B" and 21 in group "C"), and to 60 of whom it was issued for sterilization (43 in group "B," 16 in group "A," and 1 in group "C"):

TABLE 40.—*Proportionate amounts of quinine taken for immunization, based on total issue to each.*

4 individuals took no quinine whatever.
5 individuals took 1 to 9 per cent of the quinine issued them.
3 individuals took 10 to 19 per cent of the quinine issued them.
8 individuals took 20 to 29 per cent of the quinine issued them.
10 individuals took 30 to 39 per cent of the quinine issued them.
13 individuals took 40 to 49 per cent of the quinine issued them.
18 individuals took 50 to 59 per cent of the quinine issued them.
25 individuals took 60 to 69 per cent of the quinine issued them.
41 individuals took 70 to 79 per cent of the quinine issued them.
34 individuals took 80 to 89 per cent of the quinine issued them.
10 individuals took 90 to 99 per cent of the quinine issued them.
24 individuals took 100 per cent (their entire issue).

TABLE 41.—*Proportionate amount of quinine taken for sterilization, based on total issued to each individual positive in first index.*

4 carriers took 20 to 29 per cent of the quinine issued to them.
1 carrier took 30 to 39 per cent of the quinine issued to them.
4 carriers took 40 to 49 per cent of the quinine issued to them.
4 carriers took 50 to 59 per cent of the quinine issued to them.
2 carriers took 60 to 69 per cent of the quinine issued to them.
10 carriers took 70 to 79 per cent of the quinine issued to them.
7 carriers took 80 to 89 per cent of the quinine issued to them.
7 carriers took 90 to 99 per cent of the quinine issued to them.
21 carriers took 100 per cent (their entire issue).
2 data incomplete.

The degree of malaria control obtained through the use of quinine in group "B" has been ascertained by comparison of findings in connection with the first and second parasite indices (see footnote, p. 48) of the same 225 individuals. In this number are included 182 to whom quinine was issued for immunization alone,[1] and 43 to whom the drug was given for both sterilization, after detection of parasite, and immunization.

The comparative findings of the first and second indices for this group "B" are as follows:

TABLE 42.—*Malaria control, group "B," quinine.*

	Number examined.	Number positive.	Index.
			Per cent.
First index, May, 1916	225	45	20.00
Second index, December, 1916	225	16	7.11
Reduction			64.45

Sterilization of parasite carriers.—Of the 69 persons in whom malarial parasites were demonstrated at the beginning of operations, 62 remained in the territory under observation throughout the studies and were reexamined after the termination of active operations. The relative amounts of quinine taken by 60 of these has been shown in Table 41. In the second index (December) 22 persons were found to harbor parasites. Of this number 3 had been detected in the first index (May) and given quinine for sterilization purposes. The use made of the quinine was as follows:

[1] 8 persons are here included whose "quinine record" is incomplete or uncertain; they have accordingly been omitted from Table 40.

TABLE 43.—*Amount of quinine given to those found to harbor parasites in second index.*

Name.	Age.	Type of infection.	Amount of quinine taken.
			Per cent.
Milton H	7	Estivo-autumnal	43
Willie A	23	Tertian	27
Mattie S	23	.....do	(1)

[1] Data incomplete.

The foregoing are classed as failures of sterilization; in two, symtoms developed during the summer, though no loss in working time resulted, and the third remained free of manifestations. As shown in Table 33, on page 46, a total of 22 infections was found on reexamination, of which the above 3 were detected in the first index, and the remaining 19 are recorded as infections occurring during the summer despite preventive measures. The degree of sterilization obtained among the original 69 known carriers and the 62 observed throughout the period of these studies, together with the relative diminution in proven carriers prior to and following control operations, is shown in the following summaries:

TABLE 44.—*Degree of sterilization secured among carriers.*

Positive in the first index, May	69
Remaining under observation	62
Positive in both first and second indexes	3
Positive in second index, negative in first	19
Total positive in second index, December	22
Percentage Reduction in Incidence of 62 of Original Carriers	95.17
Diminution in Incidence of proven Carriers at beginning and end of observations.....per cent	68.12

The combined use of screens and quinine, group "C."—As described on page 39, the 6 tenant houses of one of the smaller plantations were screened and their 23 occupants furnished quinine for immunization during the months of June and July, at the end of which the group was merged into "A," the screen group; one carrier was also furnished quinine for sterilization. Although malaria is said to have been annual among the members of this group, no observations as to illness are recorded for the past summer; in view of the small numbers, no attempt is made to determine what has been the separate influence of the two measures employed.

Economics.—The economic losses due to the influence of malaria have been ascertained in connection with these demonstrations by comparative study of records of time lost from work and of expense incurred for medical attention and drugs by members of the several protected groups and by residents in the "negative area." Although data obtained by this method are incomplete in that they fail to

include minor impairments of efficiency and such slight disabilities as go without professional care, it is believed that a valuable index is provided whereby results may be fairly accurately gauged.

In the summaries here given, the labor of an adult male is arbitrarily valued at $1.50 per day, that of an adult female at $0.75 per day, and that of a child at $0.50 per day. The following are tabulations of losses incurred in the protected groups, and in the negative area:

TABLE 45.—*Economic losses in the controlled groups, "A" and "B," in 1916.*

Total number of families..... 104
Total individuals..... 365
Number families incurring loss because of malaria..... 3

Family.	Expense, physicians and drugs.	Time lost, in days.				
		Man.	Woman.	Child.	Cost.	Total.
Jim U.....	.....	8	.....	.....	$12.00	$12.00
Millie S.....	.....	.....	3	.....	2.25	2.25
Chas. P.....	.....	7	.....	.....	10.50	10.50
Total.....	.....	15	3	.....	24.75	24.75

Average cost per family..... $0.24
Average cost per individual..... 0.06

TABLE 46.—*Total losses in the "negative" group, 1916.*

Total number families..... 27
Total individuals (all colored)..... 126
Number families incurring loss because of malaria..... 19

Family.	Expense, physicians and drugs.	Time lost, in days.				
		Man.	Woman.	Child.	Cost.	Total.
William W.....	$15.00	7	7	0	$15.75	$30.75
Ed. W.....	3.50	.....	1	21	11.25	14.75
Anthony A.....	1.50	0	0	0	0.00	1.50
Dave C.....	14.00	0	11	0	8.25	22.25
Dan F.....	4.00	0	0	0	0.00	4.00
Will J.....	4.00	0	3	0	2.25	6.25
Dave R.....	0.00	7	0	0	10.50	10.50
Henry R.....	0.00	1	0	0	1.50	1.50
Geo. S.....	3.00	3	0	0	4.50	7.50
Morgan S.....	0.00	5	0	0	7.50	7.50
Robert W.....	2.00	14	0	0	21.00	23.00
Chas. P.....	2.00	14	0	0	21.00	23.00
Lou. Gene L.....	0.00	0	0	2	1.00	1.00
Marshall C.....	15.50	3	0	4	6.50	22.00
Walter B.....	9.00	2	0	42	24.00	33.00
Nat W.....	0.00	0	3	0	2.25	2.25
Joe S.....	1.00	0	0	90	45.00	46.00
Josh T.....	25.00	10	2	0	16.50	41.50
Will T.....	4.50	0	0	0	0.00	4.50
	104.00	66	27	159	198.75	302.75

Average loss per family..... $11.21
Average loss per individual..... 2.52

TABLE 47.—*Comparative tabulation, losses in 1916.*[1]

	Controlled groups.	Negative groups.
Average loss per family	$0.23	$11.21
Average loss per individual	0.06	2.52

[1] In the above tabulations no attempt has been made to estimate and include the economic losses due to (a) the time consumed by other members of a family in the care of the sick, or (b) diminished efficiency during convalescence from an attack of malaria, both of which would be proportionately greater in the negative group.

Investigation of reported cases of illness.—During the period of observations a total of 63 reported cases of illness occurring in the controlled groups were investigated and a clinical diagnosis of malaria made in 1; blood smears from 47 others were examined, of which 5 were found to contain parasites, making a total of 6 authenticated cases of malaria recorded. This number does not represent the total amount of malaria occurring, as in all likelihood some number of parasite examinations prove negative because of the use of quinine; the above data, however, are of interest particularly when considered in connection with the economic tables.

Condition of screens at termination of operations.—At the completion of observations at the end of March, 1917, a reexamination was made of the screening installed on 33 houses of group "A" with a view of determining the probable duration, with reasonable care, of its efficacy. All screening was found to be in excellent condition, save that with the continued use of fireplaces at the beginning of winter it was found necessary to remove most of the chimney caps because of retardation of smoke due to closure of the apertures of the screen by soot. It was recommended in each case that the caps be replaced before the beginning of the active mosquito season, and that wire, rather than wooden frames, be used to secure the screen, to obviate the risk of fire through overheating of the chimney. It is believed that, with ordinary care, protection should be had from the screening installed for at least two additional years.

Costs, with reference to control gained, and population influenced.—The approximate distributed costs of the rural malaria control operations in the present studies have been derived after analysis of the total costs of drugs, screening materials, and labor, and their comparative study with reference to the numbers of people protected by the several measures.

For the screened series, group "A," the average cost of installation of well applied galvanized iron screens on 33 houses (Vide p. 43), was $14.22, and, including the distributed costs of minor repairs, $14.59. As the duration of this material, with very ordinary care, should be at least two years, probably three, it is believed entirely justifiable to consider the "per house" cost at one-half of the latter

figure, or $7.29½, for a group dimunition of malaria of 70.6 per cent as determined by repeated parasite indices. For purposes of comparison, a per capita rate of $1.758 may be obtained; but inasmuch as all occupants of a house derive protection from its screening, and the cost per house would be, roughly, the same for large or for small families, the per house rate would appear to be more desirable.

For the series in which quinine was used, the per capita cost of the total quinine issued for both immunization and sterilization was about $0.57, for which was obtained a group reduction of malaria of 64.45 per cent, as ascertained by repeated parasite indices, and a sterilization rate of carriers detected in the first index of 95.17 per cent.

Although only approximate, the above costs are of interest for comparison with the per capita and per family economic losses from malaria, more especially in the negative group. In the following table are presented a compilation of the average approximate costs of control, the degree of control gained, and the average economic losses in the controlled and negative groups:

TABLE 48.—*Comparative table of costs of control, control gained, and economic loss.*

	Screen group.	Quinine group.	Negative group.
Per capita cost	$1.75½	$0.57	.....
Per family of house cost	$7.38½	$2.39	.....
Degree malaria reduction gained.....per cent..	70.6	64.45	.....
Average loss per capita from malaria	$0.06		$2.2
Average loss per family from malaria	$0.23		$11.3

ACKNOWLEDGMENTS.

Thankful acknowledgment is made of the active cooperation of the following and other residents of Lake Village and vicinity whereby the foregoing studies were facilitated: Mayor J. B. Simms, Former Mayor William B. Yerger, Judge E. P. Toney, Judge H. E. Cook, County Surveyor S. F. Hornor, Father J. F. Galloni, Drs. J. E. Booth, R. N. Henry, E. P. McGeehee, and M. M. Norton, and Messrs. W. B. Allen, F. W. Bormann, N. Bunker, W. H. Carpenter, S. M. Caughey, E. Davis, G. Davis, R. Jett, C. D. Owens, I. G. Owens, A. Scott, J. Simms, and J. Sloss.

SUMMARY.

Demonstration studies in malaria control were conducted during 1916 in two highly endemic localities in southeastern Arkansas by representatives of the United States Public Health Service in cooperation with the International Health Board.

Town or community unit.—At Crossett, Ark., a lumber town of 2,029 inhabitants, measures directed against mosquito production

were instituted, consisting of clearing, drainage, filling, and the use of oil and larvacides.

As ascertained by repeated parasite indices, a reduction of 77.33 per cent was obtained, and a reduction of the total visits for malaria, as compared with records of the previous year, of 70.39 per cent; for the "active" season, comprising the months from and including June to December, a reduction of visits of 82.07 per cent was obtained from the number made in the same period of the year before.

The total costs of the control operations aggregate $2,506.40, a per capita cost of $1.23½; control work is to be continued, and, much of the first work being of a permanent character, should cost substantially less.

Rural units.—On a number of plantations in the vicinity of Lake Village, Chicot County, studies of the efficacy of house screening and of quinine in immunizing and sterilizing doses were conducted.

A group of 33 houses were carefully screened at an average cost of $14.77, and their occupants carefully observed, all known carriers being given quinine for sterilization. As shown by repeated parasite indexes, a reduction of 70.6 per cent was obtained among 142 occupants; as the life of the screening installed should, with ordinary care, be at least two years, the per family cost of screening is estimated at $7.38½ per family, or $1.75¾ per capita.

In a second series, quinine was given 237 persons for immunization, and a reduction in malaria of 64.45 per cent obtained as ascertained by repeated parasite index examinations; the per capita cost for quinine issued was $0.57.

Of the 69 carriers to whom quinine was given for sterilization, 62 remained under observation and were available for re-examination; of this latter number, 3 were found to have remained infected, a reduction or "sterilization rate" of 95.17 per cent.

The economic losses suffered by a negative group of 120 persons averaged $11.21 per family, or $2.52 per capita, whereas among the members of the groups under control the family loss averaged $0.23, and that per capita $0.06.

RELATED PUBLICATIONS.

AVAILABLE REPRINTS OR BULLETINS ON MALARIA ISSUED BY THE PUBLIC HEALTH SERVICE, FROM WHICH COPIES MAY BE OBTAINED WITHOUT COST.

PUBLIC HEALTH BULLETINS.

79. Impounded Water. Surveys in Alabama and South Carolina during 1915 to determine its effect on prevalence of malaria. By H. R. Carter, J. A. A. Le Prince, and T. H. D. Griffitts. 1916.
84. Is Mosquito or Man the Winter Carrier of Malaria Organisms? By M. Brun Mitzmain. December, 1916.
88. Malaria Control: A Report of Demonstration Studies Conducted in Urban and Rural Sections. By R. C. Derivaux, H. A. Taylor, and T. D. Haas.

REPRINTS FROM THE PUBLIC HEALTH REPORTS.

28. Prevention and Destruction of Mosquitoes. By Joseph Goldberger. July 17, 1908.
105. Antimalarial Measures for Farmhouses and Plantations. By H. R. Carter. December 6, 1912.
108. Malarial Fevers—Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. December 27, 1912.
156. Malaria in North Carolina. By H. R. Carter. December 19, 1913.
159. Malarial Index Work. Methods used in Obtaining Blood, making Blood Smears and Staining. By R. H. von Ezdorf. December 26, 1913.
160. Malarial Fevers. Prevalence and Geographic Distribution in Arkansas. By R. H. von Ezdorf. January 2, 1914.
170. Prevention of Malaria. Suggestions on How to Screen the Home to Keep out Effectively the Mosquitoes Which Spread the Disease. By R. H. von Ezdorf. February 27, 1914.
172. Malarial Fevers. Prevalence and Geographic Distribution in South Carolina, Georgia, and Florida. By R. H. von Ezdorf. March 13, 1914.
175. Quinine Prophylaxis for Malaria. By H. R. Carter. March 27, 1914.
180. Malarial Fevers in the United States. By R. H. von Ezdorf. April 10, 1914.
186. Malarial Fevers. Prevalence and Geographic Distribution in Alabama. By R. H. von Ezdorf. May 1, 1914.
193. Malarial Fever. Prevalence and Geographic Distribution in Mississippi, 1913. By R. H. von Ezdorf. May 22, 1914.
217. Mosquitoes and Malaria. Report on a Short Trip in Eastern North Carolina. By Ch. Wardell Stiles. September 4, 1914.
244. Impounded Water. Some General Considerations on its Effect on the Prevalence of Malaria. By H. R. Carter. December 25, 1914.
248. Impounded Waters. Their Effect on the Prevalence of Malaria—Survey at Blewetts Falls. By H. R. Carter. January 1, 1915.
257. Impounded Waters. A Study of Such Waters on the Coosa River in Shelby, Chilton, Talladega, and Coosa Counties, Ala., to Determine the Extent to which They Affect the Production of Anophelines, and of the Particular Conditions which Increase or Decrease their Propagation. By J. A. A. Le Prince. February 12, 1915.

258. Malaria Control. Drainage as an Antimalarial Measure. By J. A. A. Le Prince. February 19, 1915.
260. Control of Malaria. Oiling as an Antimosquito Measure. By J. A. A. Le Prince. February 26, 1915.
272. Anopheline Surveys. Methods of Conduct and Relation to Antimalarial Work. By R. H. von Ezdorf. April 30, 1915.
277. Malaria in the United States. Its Prevalence and Geographic Distribution. By R. H. von Ezdorf. May 28, 1915.
290. Anopheles as a Winter Carrier of Plasmodium. The Mosquito as a Prophylactic Indicator. By M. Bruin Mitzmain. July 16, 1915.
324. Anopheles Punctipennis Say. Its Relation to the Transmission of Malaria. Report of Experimental Data Relative to Subtertian Malarial Fever. By M. Bruin Mitzmain. February 11, 1916.
328. Demonstrations of Malaria Control. By R. H. von Ezdorf. March 10, 1916.
337. Tertian Malarial Fever. Transmission Experiments with Anopheles Punctipennis. By M. Bruin Mitzmain. May 12, 1916.
359. Anopheles Infectivity Experiments. An attempt to Determine the number of persons one Mosquito can Infect with Malaria. By M. Bruin Mitzmain. September 1, 1916.
382. Malaria: A Public Health and Economic Problem in the United States. By John W. Trask. December 22, 1916.

SUPPLEMENTS TO THE PUBLIC HEALTH REPORTS.

11. What the Farmer Can Do to Prevent Malaria. By R. H. von Ezdorf. February 13, 1914.
18. Malaria—Lessons on its Cause and Prevention. (For use in schools.) By H. R. Carter. July 17, 1914.

○

89

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 89
AUGUST, 1917

LIBRARY OF
S. H. OSBORN M. D.
OCT 15 Rec'd

A SANITARY-PRIVY SYSTEM FOR UNSEWERED TOWNS AND VILLAGES

OCT 15 Filed

NOV 7 - 1937

By

L. L. LUMSDEN
Surgeon

PREPARED BY DIRECTION OF THE SURGEON GENERAL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

affected, and the denser the population, the more important it is. In densely populated centers, such as towns and cities, insanitary practices by a few persons may menace the health and offend the senses of many. Therefore, community cleanliness is even more important in our towns than in our sparsely settled country districts.

In some instances, when the administrative authorities of a town chance to give any thought to local sanitation, they become overwhelmed with the extent of corrective work which is found, even by casual observation, to be needed and relax into a state of mind that dismisses all suggestions for sanitary improvements with the pronouncement "impracticable here." In other instances, from lack of knowledge or for the purpose of making a show, the authorities expend from the public treasury, to carry out measures of relatively little sanitary importance or of very temporary effectiveness, sums of money which would be sufficient to cover the cost of measures to effect a lasting correction of the more serious insanitary conditions.

In determining a program of sanitation or of any other welfare work, a proper perspective is important. The washing of streets and the beautifying of front yards, though important, may not be so important as the cleaning of (and keeping clean) alleys and back yards. The removal of several hundred wagon loads of leaves, waste paper, old carpets, and other rubbish may accomplish much less in actual health protection than would the less costly and less conspicuous work of making sanitary a few dirty privies. The expenditure of several thousand dollars in a heroic campaign against tuberculosis may accomplish less in the actual prevention of sickness and the saving of life than would the expenditure of $100 for the "hypochloriting" of a water supply. The expenditure of large sums of money for paving extensive systems of streets before sewers are laid is generally economic folly.

The test of efficiency in the administration of public affairs is the returns in public benefit for every dollar expended from the public treasury. On this basis sanitation stands in the front rank and the cleanly disposal of human excreta is foremost among sanitary measures.

NEED OF SANITARY SYSTEMS IN TOWNS AND VILLAGES.

Considering the obvious and revolting filthiness (figs. 1 and 2) and the well-established facts as to the dangers of such insanitary conditions[1] it is remarkable that promiscuous deposits of human

[1] For a discussion of the diseases caused by faulty disposal of human excreta see Public Health Bulletin No. 68, copies of which can be obtained by sending a request to the Surgeon General, United States Public Health Service, Washington, D. C., or to a Congressman.

Fig. 1.—Insanitary conditions in a town as seen from a window of a railway dining car.

Fig. 2.—Alley in town with population of about 3,000. The privies are open and excreta deposited in them become scattered about the alley. The alley is a thoroughfare through which wagons are driven and persons walk. The privy shown in the foreground is located about 50 feet back of an unscreened confectionery shop. At the time the photograph was taken flies swarmed in both the privy and confectionery shop.

Fig. 3.—Clean alley in Cordova, Ala. The privies are fly proof and well ventilated and are provided with water-tight receptacles which are cleaned once a week.

Fig. 4.—Receptacle for use in sanitary privy system. Covers for cans are needed only in sufficient number for use in operating the scavenger service.

Fig. 5.—New box and vent flue ready for installation in old privy.

excreta, open privies, and leaking privy pits and cesspools are tolerated in any civilized community. In our country neighborhoods, in our villages and towns, and even in our larger cities such conditions, however, are commonly found.

In the three years 1914–1916, the United States Public Health Service made an intensive sanitary survey of a group of 15 fairly-representative counties located in West Virginia, Indiana, Mississippi, Maryland, North Carolina, Alabama, Kansas, Iowa, South Carolina, Georgia, Tennessee, Missouri, and Illinois. In these counties 72 incorporated towns or cities are located. These centers of population appeared at the time of the survey to present about average sanitary conditions for American towns and cities ranging in population from 500 to 20,000. Only one of them—viz, Greenville, South Carolina—was found to be free from grossly insanitary privies. Among the others the percentages of homes at which insanitary privies were in use ranged from 10 to 100, and for almost all of them the percentages were much nearer 100 than 10.

The average American town or village needs no careful survey by an expert sanitarian for an exposure of its "sore spots." A casual glance from the window of a passing train will usually detect disgustingly exposed collections of human filth (fig. 1). If, as is exceptionally the case, such conditions are not obvious from the viewpoint of the car window they are in most towns readily discoverable by a short trip through the alleys (fig. 2). Such exposure of human filth is not only offensive to the æsthetic sense, but it is also a serious menace to health.

Typhoid fever, hookworm disease, Asiatic cholera, the dysenteries, and many cases of diarrhea in infant and adult life are caused by infections which have their origin in human excreta. Since such infections may come not only from the bodies of sick persons but also from the bodies of persons who appear to be in good health, the cleanly disposal of all human excreta at all times is vitally important. From insanitary deposits of human filth, infection may be spread by hands, by chickens, dogs, rats, and other animals, by flies and other insects and by surface washing or subsoil seepage so as to reach foods and water and thence the mouths of persons.

It is unpleasant even to suspect that waste matter from human bodies frequently is introduced into the mouths of and swallowed by human beings. Yet the extensive prevalence of certain diseases proves the appalling frequence of this disgusting occurrence.

Sanitary disposal of human excreta is feasible in every civilized community, and it seems that this most essential step in municipal cleanliness should be the first to be taken by intelligent persons.

SANITARY DISPOSAL OF HUMAN EXCRETA.

Sanitary systems are intended essentially to safeguard health and they should be designed to furnish in practical operation reasonable comfort and convenience. Cleanly disposal of human excreta can be accomplished by the use of either sanitary sewerage systems or sanitary-privy systems.

For cities, towns, and villages—and also for isolated country homes—the installation of sanitary water-carriage sewerage systems, if practicable, is highly advisable. From a standpoint of comfort the advantages of well appointed water-closets properly connected with a sanitary sewer are generally understood and, therefore, such installations add materially to the commercial value of residential property.

In some instances, owing to initial cost or to lack of readily accessible and adequate water supplies, the installation of a sewerage system is not immediately feasible. Where such is the case a sanitary-privy system—which is the next best thing to a sanitary sewerage system—is to be recommended. No civilized community is so poverty stricken that it can not readily meet the expense, in money or labor, of installing and operating a sanitary-privy system.

In incorporated towns the work of installing and operating a sanitary-privy system may be conducted under the direction of the municipal authorities with uniformity and thereby with economic and sanitary advantage. In industrial settlements, such as mill villages and mining camps, which are under efficient management, such work can be carried out with facility and dispatch.

A SANITARY-PRIVY SYSTEM.

The paramount purpose of a sanitary-privy system is to provide for the collection and disposal of human excreta in such manner that this potentially dangerous matter from the time it is voided to the time it is destroyed will not be scattered about so as to be brought into contact with human bodies.

In the course of special studies of rural sanitation, conducted during the last three years by the United States Public Health Service, opportunity has been furnished by towns and villages in the group of 15 counties surveyed for a study of different methods for the installation and operation of sanitary-privy systems. Among the places in which special observations on both installation and operation of sanitary-privy systems were made are the following: Mitchell, Bedford, and three industrial villages in Lawrence County, Ind.; Jasper, Cordova, Dora, Carbon Hill, Townley, Oakman, Nauvoo, and a number of mining camps in Walker County, Ala.; Tuscaloosa, Northport, and several industrial villages in Tuscaloosa

County, Ala.; New Albany in Union County, Miss.; Cambridge, Hurlock, East New Market, and Vienna in Dorchester County, Md.; Arundel on the Bay in Anne Arundel County, Md.; Hillsboro, Chapel Hill, Carrboro, and several cotton-mill villages in Orange County, N. C.; Fredonia, Altoona, and Buffville in Wilson County, Kans.; Lindale, cotton-mill village in Floyd County, Ga.; Union City and several smaller towns in Obion County, Tenn.; Excelsior Springs, Liberty, and Smithville in Clay County, Mo.; Toledo and Neoga in Cumberland County, Ill.; Simpsonville, Greer, West Greenville, Fountain Inn., and about 15 cotton-mill villages in Greenville County, S. C. At Greenville, S. C., opportunity was had to study a sanitary-privy system comprising about 1,200 privy units which had been in operation for two years prior to the beginning of the intensive sanitary survey of Greenville County. From these fairly extensive observations and studies the sanitary-privy system herein described has been determined to be a generally practicable and reasonably satisfactory system for the sanitary disposal of human excreta.

With modifications of details, but not of principles, of construction and operation to meet local conditions this system appears to have a wide range of applicability in our unsewered towns and villages. Among its marked advantages are the relatively small cost of installation and the promptness with which it can be made effective. As was demonstrated at Excelsior Springs, Mo., in 1916, the work of installation, if carried forward in a very energetic and businesslike manner, can be completed for several hundred homes within a period of three or four days. Therefore, this system may be installed to advantage for use in unsewered sections of cities pending the lapse of time usually required for the radical extension of sewer systems.

CONSTRUCTION OF PRIVIES.

The privies in the system are provided with water-tight receptacles and with fly-proof boxes in which the receptacles are placed for use and which form the seats of the privies.

A suitable receptacle (fig. 4) is a can cylindrical in shape, 15 inches in height and 15 inches in diameter, made of galvanized iron not lighter than 24 gauge. The cans should be strongly made with well-soldered seams, so as to remain water-tight and not be easily damageable in the process of necessary handling. In continual use such cans with ordinary care should last over three years. Under the present advanced price of galvanized iron they cost from $1 to $1.25 each. One can is needed for each group of five persons or less using the privies. Public ownership of the receptacles is advantageous, and is on the same principle as the public ownership of

sewers. If bought by the municipal authorities or by cooperative organizations of citizens, the receptacles may be obtained in considerable number at one time and hence at wholesale rates. If the cans are bought by the individual householders the procurement of cans of a uniform pattern should be required by ordinance and provision made for replacement of damaged or worn-out cans with new ones from the public supply. This is necessary because of the continual interchange of cans in the operation of the scavenger service (see p. 16).

The privy boxes must be constructed so that they will serve at all times to protect the receptacles contained in them against invasion by flies, and so that a free circulation of air through their interior will be maintained.

To have all existing privies replaced with complete newly built privies of sanitary type is somewhat expensive and, under average conditions in towns, requires considerable time. The work of patching up the seats of old privies to make them of a sanitary type is attended with certain difficulties and the results, as a rule, are unsatisfactory. The engagement of competent carpenters to undertake such job work is often time consuming and difficult.

To obviate some of the main difficulties in the sanitation of the privies of a town, a plan, recommended by the writer, was carried out with very satisfactory results in Jasper, Ala., in 1915. Since then this plan has been adopted in a number of cities, towns, and villages and generally has proved expeditious and otherwise advantageous. The plan is to have new privy boxes with attachable vent flues (Figs. 5, 7, 8, and 11) built at the local lumber yards or carpenter shops and installed at a rapid rate in the old privies. By receiving ahead a sufficient number of orders the makers can arrange to turn out quickly the boxes and flues in considerable numbers and at wholesale rates. At Jasper one company was able, with 10 days' notice in advance, to supply as many as 50 boxes a day. The installation of the box and flue in the average open privy is simple, and requires little work. After the privy has been cleaned and the ground under and about it treated liberally with a strong disinfectant solution (such as chloride of lime—1 pound to 5 gallons of water), the old seat is knocked out, the flooring extended back, if necessary, to support the box, the new box put in the place of the old seat, and the flue attached to the box so as to extend on either the inside or the outside of the back or side wall of the house to a point above the roof of the privy. (Figs. 7 and 8.) The lumber in the old seat may be used for the additional flooring or for boarding up the back of the privy to protect the new box from weathering.

Fig. 6.—Privy box of one-can, adjustable-cover type, showing certain details of construction.

Fig. 7.—One-can adjustable-cover box and vent flue installed in privy.

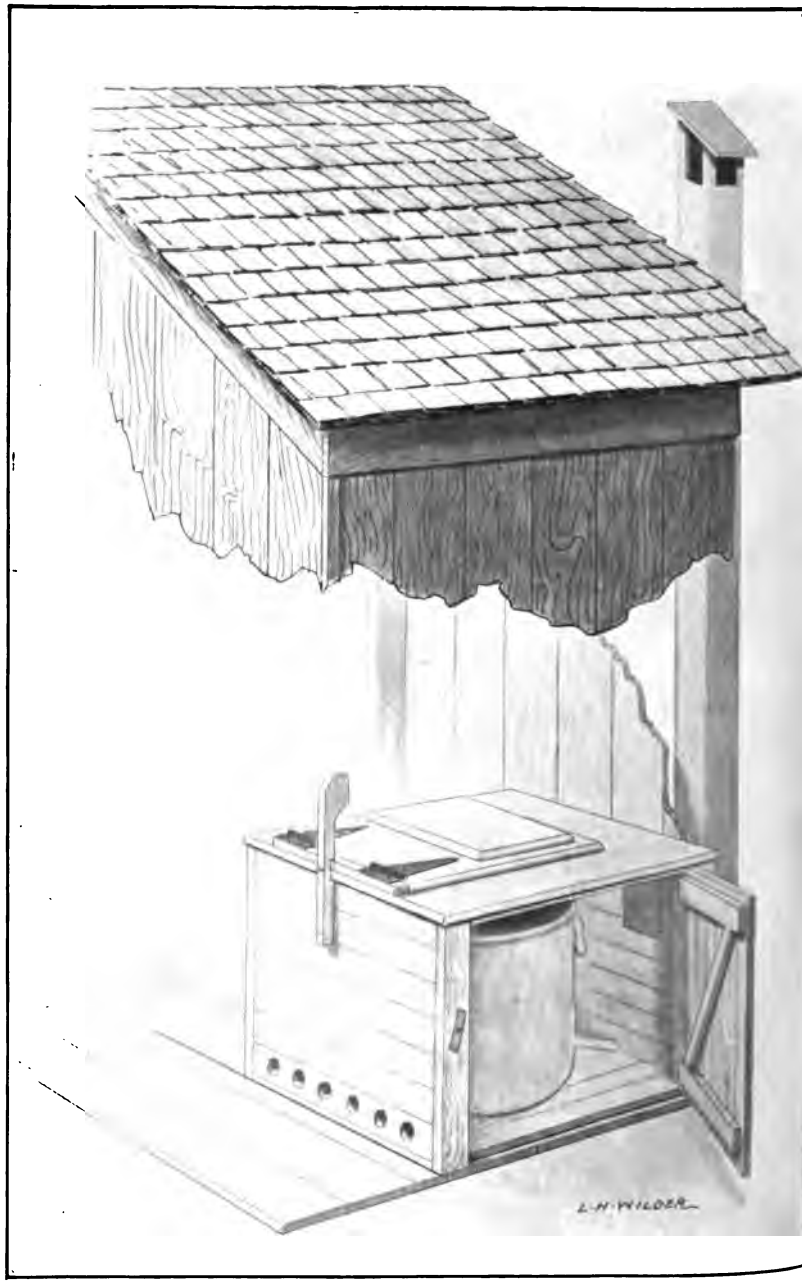


Fig. 8.—One-can fixed-cover box with back door for removal of can and with end to end ventilation. The air inlets are at left end of the box and the vent flue extends from the right end of the box through and up the side wall of the privy.

Fig. 9.—Front view of two-can box with two adjustable covers.

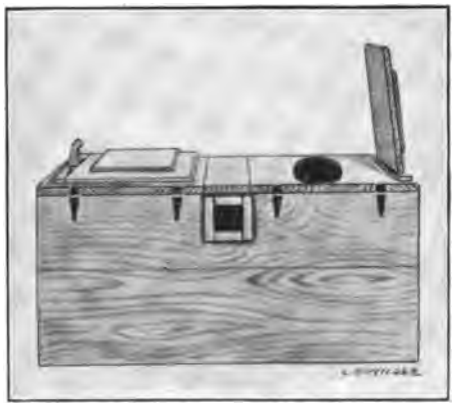


Fig. 10.—Back view of two-can adjustable cover box.

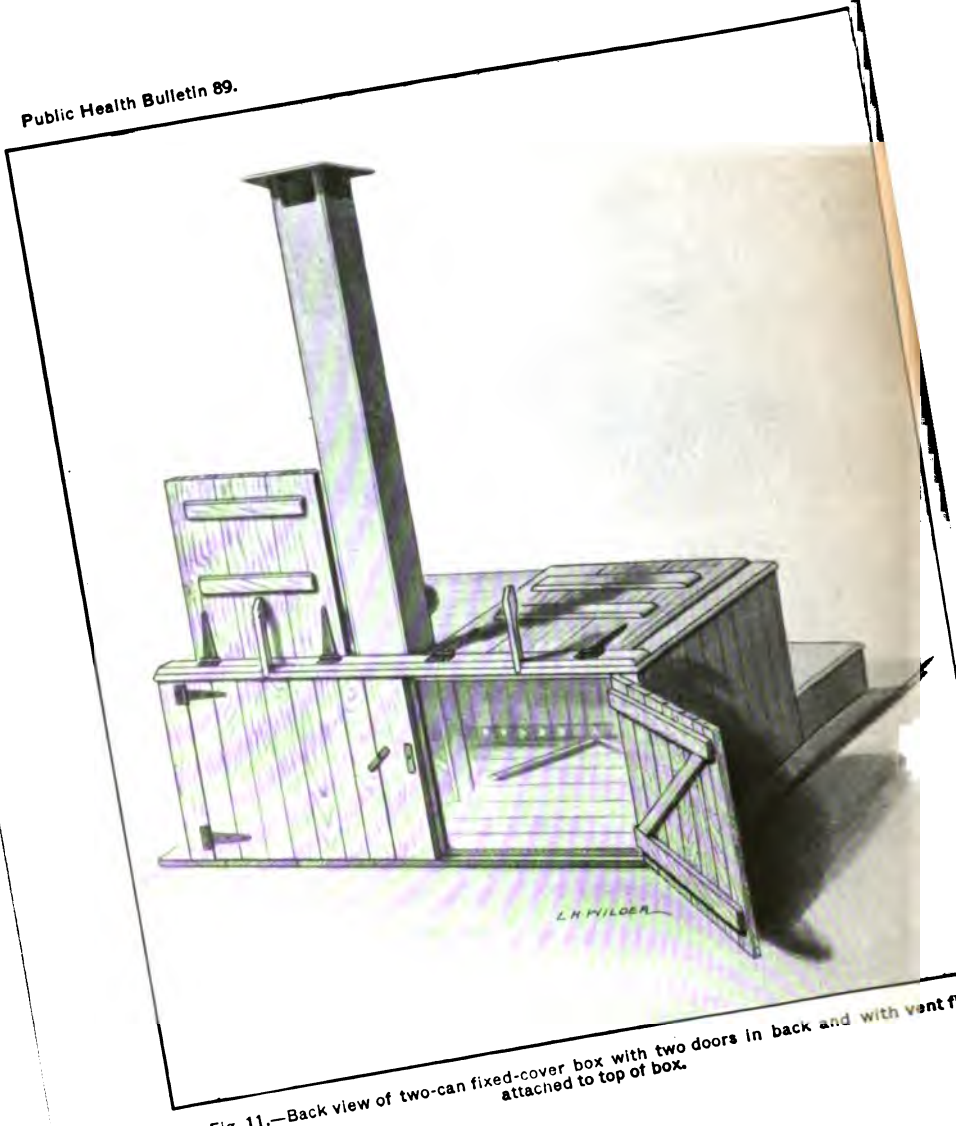


Fig. 11.—Back view of two-can fixed-cover box with two doors in back and with vent f
attached to top of box.

The boxes are made of sound, seasoned lumber, free from knot holes and cracks, not less than seven-eighths of an inch in thickness, and tongued and grooved, ship-lapped or splined. The boards to form the front and top of the box should be dressed on their outer side. The carpentry should be competent and careful so that the boxes will have all joints tight and be strong and durable. The different boxes may be made to accommodate one or more of the receptacles. For families of five persons or less a one-can privy will serve. The inside dimensions of a one-can box should be about as follows: Length 22 inches, front to back 20 inches, and height 17 inches. The inside dimensions of a two-can box should be about as follows: Length 42 inches, front to back 20 inches, and height 17 inches. Nailed in each of the four corners of the box is an upright piece of timber (Figs. 5, 6, and 8) about 2 inches square on cross section, extending from the bottom of the box either to the top or to within about 1 inch of the top, according to whether the cover of the box is to be nailed down or to be adjustable. The cover of the box rests firmly on these uprights.

The holes in the cover of the box should be oval (Fig. 9) and measure about 11 inches front to back and about 7 inches in width at the widest (back) part. The margins of the holes should be slightly beveled. Under each hole a can is kept properly placed by being shoved against two 1-inch strips (Figs. 8 and 11) about 12 inches long, nailed to the floor of the box, with front ends about 6 inches apart, to form between them an angle in which the can will fit so that its front edge will be 1 inch back of the front wall of the box and about 2 inches in front of the front margin of the hole in the seat. The front margin of the holes should be about 4 inches back of the front surface of the box.

A lid (figs. 6, 8, 10, and 11) for each hole is hinged with two metal hinges (T-butt preferably) to the cover of the box. The lid should be large enough to extend at least 1 inch in all directions around the margin of the hole. It should be reinforced to prevent warping and be well carpentered so it will lie flat over the hole and exclude flies. The lid may be hinged either at the side (so as to be at the left hand of the person occupying the seat) or at the back. If the lid is hinged at the side of the hole, the distance between it (when raised) and the left margin of the hole should be at least 6 inches. Back of the lid should be fixed a small block (figs. 8, 10, and 11) which will cause the lid when held up to incline slightly and of its own weight to fall back into place over the hole when the occupant of the seat gets up.

For use as a foot rest in front of the box a step (figs. 7 and 9) about 6 inches high is made by nailing a board nearly as long as the

box to two or three short pieces of scantling. The foot rest makes the use of the seat, which is about 19 inches above the level of the floor of the house, more comfortable and also serves to protect the screening which makes fly proof the air inlets of the box.

Inlets for air (figs. 6, 8, 9, and 11) are provided by boring through the front wall or the end of the box, on a line about 2 inches above the inside floor level of the box, holes 1 to 2 inches in diameter and 2 to 3 inches apart in a row extending the length of the box. The direction of these holes should be upward and inward at an angle of about 45 degrees to the outer surface of the box. Inside the box, covering the inner end of the air inlets, a strip of wire screening (fig. 11), wide enough to cover and to extend beyond the margins of the holes at least 1 inch in all directions, is securely fixed by means of a framing of light wood strips nailed on with small wire nails. The screening used to cover all air vents should have at least 14 meshes to the inch and be made of durable material, such as copper (preferably) or galvanoid.

The vent flue is made long enough to extend from the top of the box to a point 2 or 3 feet above the roof of the privy house (figs. 7 and 8). It should be made of sound seasoned lumber about one-half inch in thickness, with all joints tight. Its upper end is capped (fig. 11) and its lower end screened (fig. 8). On cross section the inside measurement of the vent flue should be for a one-can privy box about 4 by 4 inches and for a two-can privy box about 4 by 5 inches. The attachment of the vent flue to the box and house and the arrangement of the cover (top) of the box have to be made different for the two types of boxes suited to meet different local conditions.

The two types of boxes are (1) those with adjustable covers to permit removal of the cans through the top of the box from the interior of the privy house (figs. 5, 6, 7, 9 and 10) and (2) those with covers nailed down securely and having at the back a hinged door to permit removal of the cans from the rear of the privy house (figs. 8 and 11).

If the privies are so situated that they are accessible through the front for the scavenger work, the adjustable-cover type of box is preferable. A one-can adjustable-cover type of box (figs. 6 and 7) installed on an extensive scale in 1916 in Tuscaloosa, Ala., and the vicinity thereof, and which has proved quite satisfactory in practical use, is described in the appendix (p. 20) of this bulletin in sufficient detail to make clear the arrangement of the cover and of the air outlet for this type of box. The vent flue for this type of box consists of a long arm (about 7 feet long) and a short arm (about 8 inches long) at right angles to one another. The short arm passes

from the air vent at the upper back part of the box through the back of the privy building. Its end protruding into the box is covered with a piece of screening fastened to the flue with wood strips. It should be no longer than is necessary for it to serve its purpose. The long arm is securely braced and fixed to the outside of the back of the privy building, up which it extends to a point above the roof.

For a one-can box fixed for removal of the can through the rear (Fig. 8) the following modifications are made:

(1) The top boarding is flush with the outer surfaces of the front, back, and ends of the box, its front edge is rounded off, and on the right-hand end of the box near its upper back corner is cut a hole into which the lower end of the vent flue can be fitted tightly and firmly. The row of holes for the inlet of air is in the left end instead of the front of the box.

(2) The long arm of the vent flue extends up the side of the house, outside the building, and is securely fixed to the right wall of the house.

(3) In the back of the box is a door space, about 16 inches high and 18 inches long, which will be large enough to permit ready removal and replacement of the can. The door is hinged with two metal strap hinges so that it will swing horizontally, like the door of a room, when being opened and closed. The space within the framing for the door should be one-eighth inch higher and one-fourth inch longer than the door so as to provide a marginal space of about one-eighth inch at the top and at each end of the door. The door should be well braced with stripping nailed on its interior surface. The door when closed rests against an inset made of the uprights in the back corners of the box, the back margin of the floor of the box and a piece of stripping about 1 inch wide and one-half inch in thickness nailed along the top margin of the door space and projecting into the door space for one-fourth of an inch. The inset projects into the door space at each end also for one-fourth of an inch. When the door is closed, it rests firmly against the inset and is fastened with a button or with a hook and staple so as to exclude flies and be nearly air-tight.

For a two-can box, the principles of construction are the same as for a one-can box; but certain differences in details of construction are obviously necessary. Figures 9, 10, and 11 illustrate the two types—adjustable cover and fixed cover—of a two-can box. Although a single cover or a single back door, if very strongly made, may be used for a two-can box, the construction of a separate cover or back door (as the case may be) for each can is much more apt to give a box which is and which in practical use will remain fly proof. That

the box be fly proof and well ventilated is essential, and this should be kept constantly in mind in constructing and installing the box and flue.

For a two-can adjustable-cover box, the attachment of the vent flue to the privy box and to the back wall of the privy house is the same as for a one-can adjustable-cover box. For a two-can fixed-cover box the flue may be attached to the end of the box, as described (p. 12) for the one-can fixed-cover box, or it may be made straight and extend from the back central part of the top of the box (fig. 11) up the back wall inside the privy house and out through the roof. The latter arrangement gives somewhat better ventilation than the former; but to carry the vent flue through the roof requires somewhat more work than to carry it through the side of the privy house.

If the vent flue is attached to the right end of the box, the holes for the inlet of air instead of being in a row along the front of the box should be either in a nest at the lower left corner of the front, or better still, if the width of the privy house permits, in a row (fig. 8) or nest near the floor in the left end of the box.

A coat of paint on the parts of the box and flue which are exposed to weathering will tend to prevent warping and will increase the durability of the apparatus.

In most sections of the United States, a box and flue, constructed as described above, can be furnished by local makers at a reasonable profit for $2.50 to $3.50 for a one-can box, and for $3 to $4 for a two-can box. The work of installing the apparatus averages in cost. for each privy about 50 cents, and rarely should exceed $1.

The expense of obtaining and having installed the boxes and flues should be borne by the property owners; but if for any reason a tenant should have to bear this expense there would be no cause for serious objection, since the tenant could remove and take with him this apparatus, along with his other personal property, when moving to another place.

From a strictly sanitary standpoint the box and the receptacle constitute the essential parts of the privy. The privy house should be so constructed that it will afford privacy and reasonable comfort to the users. As an additional safeguard, it is advisable, but not essential. for the privy house itself to be of fly-proof construction.

The apparatus described in this bulletin is simple and inexpensive, and can be made almost anywhere and by almost anybody of fair intelligence. It complies with the minimum requirements for a sanitary privy. Such an apparatus, if so desired, may be made of more expensive material and of more attractive workmanship; but no matter how well made the apparatus will not serve the purpose of a sanitary device unless properly used.

USE OF PRIVIES.

Sanitary privies in order to furnish the health protection for which they are intended must be used in a cleanly manner for the reception of all excreta (stools and urine) from all persons for whom they are provided. If at a home at which a sanitary privy has been installed the children or other members of the household deposit their excretions in the yard or alley or other places outside the privy the sanitary privy will furnish for that household and for the community only a part of the protection which it is capable of giving. The soiling of the floor, the seat, or the other woodwork of the privy with excreta is inexcusable, and with the exercise of very little care and sense of decency can be avoided easily. Adults of ordinary intelligence, and even little children, can be taught quickly how to use a sanitary privy in a cleanly manner.

Only human excreta and toilet paper should be deposited in the receptacles. The receptacles (cans) must not be permitted to overflow. They should be removed for emptying and cleaning before they become more than two-thirds full. The lids over the holes in the seat must be kept closed down when the seat is not occupied. If the lids are left up, flies will get to the excreta, and thus the work to make the privy of fly-proof construction will have availed nothing. If any flies are about the privy box, they should be scared away or "swatted" before the lid over the hole is raised for occupancy of the seat. If a fly should get into the privy box while the seat is occupied, it should be scared out before the lid is replaced over the hole. A fly swatter should be kept in the privy convenient to hand. The keeping of a piece of sticky fly paper in the privy box is an additional safeguard. The dangerous fly is the one which has had access to human excreta, and, therefore, the privy is the most important place to keep free from flies by "swatting" and other measures.

The ventilation is sufficient to prevent markedly disagreeable odors, and odors can be still further controlled by the use of disinfectant solutions or drying powders in the receptacles. The disinfectant or drying powder selected for this purpose should be one which will not corrode the cans. As a disinfectant, compound cresol solution, or some other good coal-tar preparation, is suitable; and as drying powders, finely powdered dry earth and wood ashes are good.

UPKEEP OF PRIVIES.

The privies must be kept in a good state of repair. Responsibility for this should be placed upon occupants and owners of properties. The scavenger should be required to report the need of repair and the faulty use of privies. If the cans become leaky, they must be

replaced at once with good cans. If, from warping or swelling of the boarding or from rusting of the wire screening, the privy box ceases to be fly proof, corrective work should be done at once. To insure proper upkeep and care of privies, frequent and systematic inspection should be made by a duly appointed sanitary inspector or sanitary policeman or other person with police authority.

DISPOSAL OF PRIVY CONTENTS.

A sanitary privy is a device for the reception and storage of human excreta in such a way that the excreta, pending final disposal, will not be scattered about by any agent or conveyed through any agency so as to reach human bodies. If the excreta are not removed from the sanitary privies and finally disposed of in a cleanly manner, the effect of the sanitary privies in the excreta-disposal system is nullified.

For the collection and disposal of privy contents a scavenger service should be operated by or under the direction of the municipal authorities. The privy cans are collected, emptied, and cleaned at least once every seven days.

For collecting privy contents suitably framed wagons (fig. 12) are used. The scavenger team starts out on the collecting round with the wagon loaded with cleaned (and disinfected) cans provided with well-fitting friction covers. Upon arrival at each privy the cans in the privy are taken out, a suitable quantity of a disinfectant solution added to their contents, the covers from the empty cans securely placed on them, the empty cleaned cans put in their place in the privy and the full cans put on the wagon in the place of the empty cans. The round is continued in this way so that when all the empty cans have been placed in privies the wagon is loaded with an equal number of filled cans and is ready to go to the disposal field. This method of collection obviates the dangers and offensiveness of emptying (and often splashing about) the contents of privy receptacles in yards and alleys in the immediate vicinity of residences, and is very much better than any method of collection which requires the emptying and cleaning of cans at the privies. The scavenger work can be, and should be, done in the daytime. To operate this method of collection and removal of privy contents, it is, of course, necessary (as has been stated before) for the cans used in the privy system to be of a uniform pattern.

Final disposal of the contents of the privy receptacles can be satisfactorily accomplished by discharge into a sewer (if sewers are available) or by burial. In partly sewered towns or cities the matter can be safely disposed of most conveniently and at least cost by discharging it into a sewer. By so doing, however, the value of the matter as a fertilizer is usually lost. For disposal through a

Fig. 12.—Scavenger wagon. The frame has slats fixed lengthwise and crosswise so as to form a compartment for each can.

Fig. 13.—Disposal of privy contents through sewerage system. The cement box (A) surrounds the manhole of a sewer. The barrel (B) contains disinfectant solution. The loaded cans are taken from one platform (C) and after being cleaned are placed on the other (D) for removal by the scavenger wagon.

Fig. 14.—Emptying privy receptacles in plowed furrow.

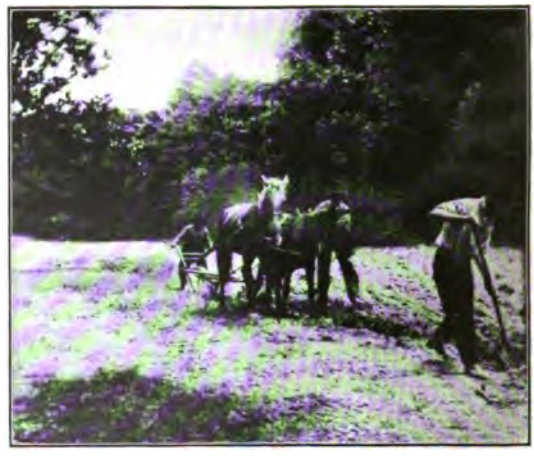


Fig. 15.—Disposal of privy contents by burial. The matter is spread in the furrow and plowed under. Spots not covered by plow are covered with the shovel.

sewerage system a sufficient number of stations (fig. 13) to prevent the hauls from being too long are established. At each station a cement box, about 4 feet high and about 6 feet in diameter, is built around a manhole of a sewer. The floor of the box slopes from each wall toward the center. An iron grating to hold back coarse matter which would tend to clog the sewer is fixed over the manhole. A hose carrying water under pressure is provided. The contents of the cans are emptied into the box, the hose is first turned on the interior of the can to wash it out thoroughly and then on the matter emptied from the cans to wash it through the grating into the sewer. Near the box a tank or barrel of disinfectant solution is kept, and into this solution the cans, after being emptied and cleaned, are dipped. About a pint of the disinfectant solution is left in each can. The top is placed on the can, and the can is ready to be placed on the wagon for the next round of collection.

For disposal by burial (figs. 14 and 15) a field should be selected which is not more than a mile or two distant from the points of collection and which is not to be cultivated for at least a year after use as a disposal ground. In such a field a furrow about 8 inches deep is run with a plow. The receptacle contents are spread along the furrow in a layer not more than 2 or 3 inches deep. Then a parallel furrow is run so that the earth from it is thrown over the matter in the previously made furrow. Spots not covered by the plow should be carefully covered by hand with a hoe or shovel. The soil covering the excreta should be at least 3 inches deep. By this method about 3,000 bushels of privy contents can be buried on each acre of land. The matter is in the active upper layer of the soil and undergoes rotting, with destruction of whatever disease-producing agents may be contained in it. The excreta are high in valuable fertilizer principles, and poor land used as a disposal ground becomes markedly enriched and consequently of increased value. At least 12 months after burial of the matter should elapse before the burial field is cultivated or otherwise used. In this time all danger from the buried matter is passed. The field selected should be one which is at a safe distance (at least 400 yards) from, and preferably downhill from, any source of water supply used for drinking purposes. In using a field for burial of the matter, provision must be made for washing and disinfecting the cans.

Burial is not so convenient as discharge into a sewer; but by burial this excellent fertilizer can be conserved to economic advantage. The determination of a practicable and economical method for treating human excreta with chemicals or with heat, so as to make the matter safe for convenient use as a fertilizer without markedly decreasing the fertilizer principles, could be expected to

furnish a source of revenue which would meet in part, and in some localities perhaps in whole, the cost of operating the scavenger service. Studies are now being made at the hygienic laboratory of the Public Health Service with a view of determining the practicability of such treatment of privy contents.

A scavenger service, as described above, operated for the cleanly collection and safe disposal of excreta from the sanitary privies can be supported with a margin of profit to the municipality by a charge of $3 or $4 a year for each privy. The scavenger fees should be collected from the occupants of the properties, whether the occupants be owners or tenants. For each home with a sanitary privy, the cost of adequate scavenger service is about the same as is the cost in the average American city of the water used for the operation of a flush water-closet.

In freezing cold weather the contents of some of the cans may become frozen solid. To remove the excreta from the cans when such is the case, the can may be immersed for a minute or two in a tank of hot water; or, more conveniently, by the use of a plumber's torch applied lightly to the outside of the can. After such warming of the can the excreta will drop out in a solid block when the can is inverted. In localities having a season sufficiently cold to interfere with plowing, trenches two or three feet deep should be dug in the disposal field and marked with stakes before the ground freezes. The trenches should be ample to contain the privy contents, which will have to be disposed of during the cold season. The excreta in the trenches should be covered with earth as soon as the ground thaws.

SEQUENCE OF STEPS IN THE INSTALLATION OF A SANITARY-PRIVY SYSTEM.

Unless the persons who are to use the privies and who are to pay the cost of installing and operating the system have an understanding of the importance of the work and are in sympathy with the public improvement, a sanitary-privy system can not be expected to subserve fully its purpose. Therefore, the first step is to arouse a sanitary sense among the people generally of the community. To do this, public meetings for discussions of sanitation, newspaper articles, sermons on sanitation by local clergymen, crystallization and coordination of sentiment in existing civic organizations or through newly formed sanitation clubs, house-to-house canvassing, and various other measures may be employed. When public interest has been sufficiently aroused, the town authorities should hold a public meeting to give a hearing to citizens who may wish to express themselves either for or against the proposed improvement. If sanitation can be made an issue in the community, those who favor the correction

of grossly insanitary local conditions will practically always win. The next step is to pass an ordinance. The Tuscaloosa ordinance (see p. 20 of this bulletin), with necessary modifications to meet local conditions, is generally applicable. The ordinance should be passed and promulgated 30 or 60 days before it is to become effective. In this period the receptacles for the privies and the equipment for the operation of the scavenger service can be obtained by the municipal authorities, and the privy boxes and flues can be obtained by the property owners. As soon as the scavenger service is ready to begin the thorough cleaning of the old privies the carpenters begin the installation of the privy boxes—each box containing its required number of cans. This last step in the work of installing the system should be carried out in an energetic and business-like way on schedule time. Upon completing the installation of the system, the town is entitled to a "boost," and a sanitation celebration is in order.

Through sanitary inspection, promulgations by the municipal authorities, coordinated efforts of civic organizations, newspaper articles and the distribution of health bulletins, the people generally of the community should be impressed with the fact that a sanitary-privy system can not take care of itself, and that intelligent cooperation from them in the use and upkeep of the privies is essential.

APPENDIX.

AN ORDINANCE ADOPTED AND PROMULGATED BY THE BOARD OF COMMISSIONERS OF THE CITY OR TUSCALOOSA, ALA.

SECTION I. It shall be unlawful for any property holder or his authorized agent to permit, upon any of his property in Tuscaloosa, a privy or dry closet of any kind or description for the reception of human excreta, to be maintained or to exist where any of the improvements on said property are connected with a public sewer of said city.

SEC. II. It shall be unlawful for any person in Tuscaloosa to throw out, deposit, or bury within the city limits any excreta from human bodies, solid or liquid, or to dispose of such substance in any manner other than into a properly sewered water-closet or a properly constructed sanitary privy.

SEC. III. All buildings or other places in said city where human beings live, are employed, or congregate shall be provided with a sewered water-closet or a sanitary privy for the catchment or receiving of human discharges.

SEC. IV. It shall be unlawful for any property holder or his authorized agent to construct, maintain, or permit to exist on any property or properties under his control where sewer connection has not been made, a privy, unless the same is sanitary or is constructed as provided hereinbelow.

SEC. V. A sanitary privy is one so built, rebuilt, or constructed that (*a*) the execreta deposited therein will not fall upon the ground, but in some water-tight receptacle, and (*b*) the contents of which receptacle shall not be accessible to flies, fowl, or small animals at any time. (*c*) The box parts of said privy shall be constructed of sound lumber, all joints being made tight. Said box is to be provided with a lid closely fitting, and the seat thereon is to be covered with a self-falling hinged lid, so as to render such box fly proof. (*d*) Proper ventilation of such box shall be provided by means of suitably placed openings or flue. Such ventilating openings are to be screened with a good grade, 14-mesh wire screening. (*e*) Such privies shall be so located as to be easily accessible to the scavenger for cleaning.

SEC. VI. The health officer of Tuscaloosa shall prescribe by regulations proper sizes and methods of construction of such privies, and such other details as will render this ordinance effective and its application uniform. All such privies must conform to such regulations.

SEC. VII. The contents of all privy receptacles shall be removed by the city scavenger. Such removal and cleaning shall be done under the supervision of the city health officer, and for such services the following charge shall be made: For cleaning each privy at private homes, one dollar ($1) per quarter in advance from each family using such privy; for all privies containing more than one receptacle, an additional charge for each receptacle shall be twenty five (25) cents per quarter in advance.

The fees or charges set out in this section shall be paid by the occupant or owner of said premises or each family using such privy to the sanitary officer or at the office of the city clerk at the beginning of each quarter: *Provided, however*, That a deduction of twenty-five (25) cents shall be made from the above charges if same are paid within the first 10 days of each quarter.

SEC. VIII. All sanitary privies in said city shall be kept in a cleanly condition at all times, and so used that all excreta deposited therein will fall into the

receptacle provided. Such receptacle shall be used only for the purposes of a toilet, and no wash water, garbage, or other refuse matter other than human excreta shall be deposited therein.

SEC. IX. No privy receptacle shall be permitted to become filled to overflowing. If emptying of privy receptacles becomes necessary oftener than hereinbefore provided, it shall be the duty of the occupant of the property to notify the city health officer, and such privy shall be cleaned and an additional charge of 10 cents will be made for each receptacle so emptied.

SEC. X. All privies existing or maintained in said city after the date on which this ordinance takes effect which do not comply with the requirements of this ordinance or the regulations of the city health officer issued under this ordinance shall be and are hereby declared a nuisance, dangerous to the public health; and the city of Tuscaloosa shall proceed to abate such nuisance in accordance with law or the ordinances of said city.

SEC. XI. The city shall have the further right to make or cause to be made such alterations or constructions to such privies as are nuisances as will render them sanitary, and the entire cost of such work shall be charged against the person creating or maintaining the same. All such alterations or constructions are to be prescribed and approved by the city health officer.

SEC. XII. All receptacles for sanitary privies in Tuscaloosa shall be furnished by the city of Tuscaloosa, but the same shall remain the property of said city. It shall be unlawful for any person to take, destroy, misplace, or misuse any of such receptacles.

SEC. XIII. The health officer of the city of Tuscaloosa or a duly appointed inspector shall personally inspect all privies in Tuscaloosa as such inspection shall be deemed necessary by such health officer or inspector. The city health officer or a duly appointed inspector is hereby empowered to enter all premises in the discharge of this duty.

SEC. XIV. It shall be unlawful for any person to fail or refuse to comply with the provisions of this ordinance.

SEC. XV. Any person who violates any of the provisions of this ordinance or the regulations issued by the city health officer, or any person who in any way obstructs the city health officer or his duly authorized agents, or the scavenger in the proper discharge of the duties prescribed in this ordinance shall, upon conviction, be fined in a sum not more than one hundred dollars ($100), and may also be sentenced to hard labor for the city for a period of time not exceeding six months.

SEC. XVI. That all ordinances or parts of the same in conflict with the provisions of this ordinance are hereby repealed.

SEC. XVII. This ordinance shall become effective on the 15th day of May, 1916.

Adopted this 14th day of April, 1916.

REGULATIONS MADE IN CONFORMITY WITH PROVISIONS OF ABOVE ORDINANCE.

REGULATIONS REGARDING THE CONSTRUCTION AND MAINTENANCE OF SANITARY PRIVIES.

DEPARTMENT OF HEALTH, CITY OF TUSCALOOSA, ALA.

Prepared by the city health officer of the city of Tuscaloosa under the authority of and in amplification of ordinance No. 311 of the board of commissioners of the city of Tuscaloosa, Ala.

Definition.—A sanitary privy consists essentially of a water-tight can or receptacle for the catchment of human excreta, kept in a properly ventilated fly-proof box or container.

According to ordinance No. 311 it is unlawful after May 15, 1916, to permit any privy to exist in the city of Tuscaloosa unless the same is sanitary, and the city health officer is authorized to prescribe by regulation proper sizes and methods of construction of such privies and such other details as will make the ordinance effective and its application uniform. Therefore these regulations are promulgated by the city health officer, and all privies in the city must be made to confrom to them.

(1) The box part of the privy shall be constructed as follows:

(*a*) Of sound seasoned lumber free from knot holes and cracks, not less than five-eighths inch tongued and grooved stock, dressed at least on one side. The box to be securely made, well nailed, and all joints made tight.

(*b*) The inside dimensions to be not less than: (1) For a single-can box, 20 inches deep by 22½ inches wide; (2) for a double-can box, 20 inches deep by 42 inches wide; (3) for all boxes the inside height shall be 16½ inches.

(*c*) The box shall be provided with a closely-fitting lid, which forms the seat of the privy, projecting over the outside front and side surfaces of the box 1 inch and having nailed on to its underside four strips about 1 inch square, which shall project into the inside of the box, so as to prevent the lid from slipping on the box and in order to make a fly-tight joint. The lid shall have a hole or holes of approximately 9-inch diameter, the front edge of which shall be, when the lid is in place, not less than 1½ inches from the front inside face of the box. This lid is to be lifted up and set to one side when the can is being removed or it may be hinged so as to lift up to the rear.

(*d*) Each hole in the lid is to be provided with a self-falling hinged cover of dimensions sufficient to overlap the hole in all directions by at least 3 inches. The cover shall be made so as to prevent its warping and so that it will at all times, except when the privy is in use, lie flat over the hole. Each cover must be hinged with 2 metal hinges, securely fastened with screws. It is suggested that wherever possible all covers be hinged so as to lift up to the user's left-hand side.

(*e*) All boxes shall be ventilated in the following manner: (1) By a horizontal series of holes of approximately 1 inch diameter and 4 inches apart, located in the front wall of the box, 1½ inches above the floor of the box; and (2) by a single hole 4 inches square located at the center of the upper edge of the rear wall of the box; (3) all these ventilation holes must be covered by a good-grade copper wire screening of not less than 14 meshes to the inch, secured to the inside of the box by strips of wood; (4) a ventilation flue built of approximately three-fourths-inch sound stock and of not less than 4-inch inside cross section shall extend from the square hole in the box to a point above the roof on the outside of the privy building. This flue must be capped and securely supported.

(*f*) Blocks of wood not less than 2 inches high shall be nailed to the bottom of the box in such a manner that the can will be located so that all excreta will fall into the can. The sides of the can must be at all times at a distance greater than 1½ inches from the horizontal projection of the hole in the lid of the box.

(*g*) Blocks of wood shall be secured to the inside wall of the privy building or to some similar surface in such a manner and in such a place or places that the covers of all holes can not remain raised.

(2) All cans used in these boxes for the catchment of human excreta are to be furnished by the city and will at all times remain the property of the city, and

ccording to section XII of said ordinance it is "unlawful for any person to ake, destroy, misplace, or misuse any of such receptacles." Property occupants nd owners shall be held responsible in case of damage to cans for the cost of heir replacement. These cans are straight sided, 15 inches high by 15 inches a diameter.

(3) All privies now existing shall be remade to conform to these regulations, nd all new privies shall be made to conform to them, except as provided below.

(4) The occupant of the privy shall not disturb the can or its contents. No an shall be allowed by the occupant to overflow; and if it becomes necessary o empty the can oftener than the regular stated interval, it is the duty of the ccupant of the property to notify the city health officer, and the privy will be leaned and an additional charge of 10 cents will be made for each receptacle o emptied. If it becomes necessary, dry earth may be used to absorb the quid matter in the can in order to prevent an excess of odors. No other subtance, such as lime, shall be used by the occupant, either in the can or box.

(5) The occupant, or in unoccupied property the owner, shall be held responible for the maintenance at all times of the privy in a clean condition and for he proper observance of these regulations. No privy or any of its appurenances shall be allowed by the owner or occupant to be maintained in any nsanitary condition or except as described in these regulations.

(6) Wherever the owner or occupant of a property desires to install some nethod of disposing of human excrement, other than the bucket and box type, uch as a septic tank or a so-called "L. R. S." privy, he shall be allowed to do o, provided that the plans and construction of each and all such installations hall have been approved by the city health officer.

(7) All privies or buildings used as privies shall be easily and at all times ccessible for inspection and cleaning.

(8) The ordinance further provides in section 15 that "any person who violates any provision of this ordinance or of the regulations issued by the city health officer or in any way obstructs the city health officer or his duly authorized agents or scavenger in the proper discharge of the duties prescribed in this ordinance shall be fined upon conviction in a sum not more than $100, and may also be sentenced to hard labor for the city for a period not exceeding six months."

(9) The decision of the city health officer shall be final in all interpretations of and in disputes arising from these regulations.

Issued this the 22d day of April, 1916.

J. J. DURRETT, M. D.,
City Health Officer.

DISCUSSION.

This ordinance was backed by strong public sentiment and was rigidly enforced. In consequence radical improvement in sanitary conditions and a marked reduction of the sickness and death rates resulted. Prior to the campaign for sanitation there were in the city 1,158 open insanitary privies. One hundred and twenty-six were abolished and replaced with sanitary water-closets connected with the sewers, and 1,032 were remodeled so as to be of sanitary type.

Typhoid-fever incidence was reduced from 190 cases (estimated), with 17 deaths, for 1915, the year before the sanitary work was done, to 14 cases, with 1 death, for 1916. Of the cases occurring in 1916, 6 gave histories showing that the infection was contracted outside the city.

The effectiveness of sanitation demonstrated in Tuscaloosa is typical.

RELATED PUBLICATIONS.

Available reprints and bulletins on typhoid fever, rural sanitation, water supplies, and sewage pollution issued by the Public Health Service.

Those marked "Exhausted" may be obtained from the Superintendent of Documents, Washington, D. C., at the indicated cost; all others may be obtained without cost from the United States Public Health Service, Washington, D. C.

HYGIENIC LABORATORY BULLETINS.

35. Report on the Origin and Prevalence of Typhoid Fever in the District of Columbia. By M. J. Rosenau, L. L. Lumsden, and Joseph H. Kastle (including the following articles: Sanitary Inspection of Table Water Vended in Washington, D. C., by Joseph Goldberger; Typhoid Bacillus Carriers, by Joseph Goldberger; The Longevity of B. Typhosus Outside the Human Body, by A. M. Stimson; The Alleged Rule of Intestinal Worms as Inoculating Agents in Typhoid Fever, by Ch. Wardell Stiles; A Sanitary Survey of the Drainage Basin of the Potomac River, by Joseph Goldberger). February, 1907. 361 pages. 9 maps. 7 charts. 2 diagrams. 6 figures. Paper. $1. Exhausted.

44. Report No. 2 on the Origin and Prevalence of Typhoid Fever in the District of Columbia. 1907. By Mr. M. J. Rosenau, L. L. Lumsden, and Joseph H. Kastle. 63 pages. 7 maps. 4 charts. Paper. 25 cents. Exhausted.

52. Report No. 3 on the Origin and Prevalence of Typhoid Fever in the District of Columbia. By M. J. Rosenau, L. L. Lumsden, and J. H. Kastle. October, 1909. 160 pages. 10 charts. 10 maps. Paper.

56. Milk and Its Relation to the Public Health. (Revised and enlarged edition of Bulletin No. 41.) By various authors. March, 1909. 828 pages. 67 charts and illustrations. Paper. $1. Exhausted.
    1. Introduction by Walter Wyman.
    2. Milk as a Cause of Epidemics of Typhoid Fever, Scarlet Fever, and Diphtheria. By John W. Trask.
    3. The Milk Supply of Cities in Relation to the Epidemiology of Typhoid Fever. By L. L. Lumsden.
    17. Sanitary Water Supplies for Dairy Farms. By B. Meade Bolton.
    18 Methods and Results of the Examination of Water Supplies of Dairies Supplying the District of Columbia. By B. Meade Bolton.

66. II. An Organism (*pseudomonas protea*) Isolated from Water, Agglutinated by the Serum of Typhoid Fever Patients. By W. H. Frost. 14 tables. 4 charts. References. June, 1910. 108 pages. Paper. 15 cents. Exhausted.

72. I. Report on an Outbreak of Typhoid Fever at Omaha, Nebr. (1909–1910). By L. L. Lumsden. 6 tables. 4 maps. 5 charts. Appendix.
    II. The Water Supply of Williamson, W. Va., and Its Relation to an Epidemic of Typhoid Fever. By W. H. Frost. 13 tables. 1 map. 3 charts. November, 1910. 90 pages. Paper. 15 cents. Exhausted.

77. Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever. I. Lake Erie and the Niagara River. By Allan J. McLaughlin. July, 1911. 169 pages. 55 charts. 16 maps. Paper. 25 cents. Exhausted.

78. Report No. 4 on the Origin and Prevalence of Typhoid Fever in the District of Columbia (1909). By L. L. Lumsden and John F. Anderson. (Including articles contributed by Thomas B. McClintic and Wade H. Frost.) October, 1911. 196 pages. 27 charts. 15 maps. Paper.

83. Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever. II. Lake Superior and St. Marys River. III. Lake Michigan and the Straits of Mackinac. IV. Lake Huron, St. Clair River, Lake St. Clair, and the Detroit River. V. Lake Ontario and the St. Lawrence River. By Allan J. McLaughlin. March, 1912. 296 pages. 91 charts. 39 maps. Paper. 30 cents. Exhausted.

89. Sewage Pollution of Interstate and International Waters, with Special Reference to the Spread of Typhoid Fever. VI. The Missouri River from Sioux City to its Mouth. By Allan J. McLaughlin. May, 1913. Paper. 84 pages.

96. I. Report of Investigation of Coastal Waters in the Vicinity of Gulfport and Biloxi, Miss., with Special Reference to the Pollution of Shellfish. By R. H. Creel.

II. A comparison of Methods for the Determination of Oxygen in Waters in Presence of Nitrite. By Elias Elvove.

VIII. Note on a New Apparatus for Use with the Winkler Method for Dissolved Oxygen in Water. By Hyman L. Shoub. August, 1914.

100. II. Examination of Drinking Water on Railroad Trains. By Richard H. Creel. November, 1914.

104. Investigation of the Pollution and Sanitary Conditions of the Potomac Watershed, with Special Reference to Self-Purification and the Sanitary Condition of Shellfish in the Lower Potomac River. By Hugh S. Cumming. Plankton Studies by W. C. Purdy, and Hydrographic Studies by Homer P. Ritter. February, 1916.

PUBLIC HEALTH BULLETINS.

37. The Sanitary Privy: Its Purpose and Construction. By Prof. C. W. Stiles. 1910. 24 pages. 12 figures. Paper.

51. The Causation and Prevention of Typhoid Fever, with Special Reference to Conditions Observed in Yakima County, Wash. Appendix A: The Construction and Maintenance of a Sanitary Privy. Appendix 2: Measures to Prevent the Spread of Infection from the Bedside of a Typhoid Fever Patient. By L. L. Lumsden. November, 1911. 53 pages. 5 charts. 13 figures. 2 maps. Paper. 20 cents. Exhausted.

65. Typhoid Fever in Rockville, Md.: Report of an Outbreak Caused by an Infected Water Supply from a Deep Well. By L. L. Lumsden. 5 cents. Exhausted.

68. Safe Disposal of Human Excreta at Unsewered Homes. By L. L. Lumsden, C. W. Stiles, and A. W. Freeman. April, 1915.

69. Typhoid Fever: Its Causation and Prevention. By L. L. Lumsden. May, 1915.

70. Good Water for Farm Homes. By A. W. Freeman. May, 1915.

74. Investigation of the Pollution of Tidal Waters of Maryland and Virginia, with Special Reference to Shellfish-Bearing Areas. By Hugh S. Cumming. March, 1916.

86. Investigation of the Pollution of the Tidal Waters of New Jersey, New York, and Delaware, with Special Reference to Shellfish-Bearing Areas. By H. S. Cumming.

87. Stream Pollution: A Digest of Judicial Decisions and a Compilation of Legislation Relating to the Subject. By Stanley D. Montgomery and Earle B. Phelps.

89. A Sanitary Privy System for Unsewered Towns and Villages. By L. L. Lumsden.

REPRINTS FROM PUBLIC HEALTH REPORTS.

42. Soil Pollution and Its Relation to Hookworm Disease and Typhoid Fever. By Ch. Wardell Stiles. October 1, 1909. 10 pages. 3 illustrations. Paper. 5 cents. Exhausted.

46. What the Local Health Officer Can Do in the Prevention of Typhoid Fever. By L. L. Lumsden. February 4, 1910. 14 pages. Paper. 5 cents.

48. What the Mayor and City Council Can Do in the Prevention of Typhoid Fever. By L. L. Lumsden. June 17, 1910. 14 pages. Paper. 5 cents. Exhausted.

54. Preliminary Note on a Simple and Inexpensive Apparatus for Use in Safe Disposal of Night Soil. By L. L. Lumsden, Norman Roberts, and Ch. Wardell Stiles. November 11, 1910. 7 pages. 1 il. Paper. 5 cents. Exhausted.

56. Report on an Outbreak of Typhoid Fever at Des Moines, Iowa. By L. L. Lumsden. January 27, 1911. 26 pages. 2 charts. 1 map. Paper. 5 cents. Exhausted.

58. The Typhoid Bacillus Carrier: A Review. By R. M. Grimm. March 17, 1911. 17 pages. Paper. 5 cents. Exhausted.

66. Antityphoid Vaccination. Extracts from the Report of the Commission Appointed by the Academy of Medicine of Paris. Translation by Joseph W. Schereschewsky. October 6, 1911. 25 pages. Paper.

67. Origin and Prevalence of Typhoid Fever in Fort Smith, Ark., and Measures Necessary for Its Control. By W. H. Frost. October 27, 1911. 19 pages. Paper. 5 cents. Exhausted.

72. Vegetables as a Possible Factor in the Dissemination of Typhoid Fever. By R. H. Creel. February 9, 1912. 9 pages. Paper.

76. The Necessity for Safe Water Supplies in the Control of Typhoid Fever. By A. J. McLaughlin. March 22, 1912. 13 pages. 5 tables. Paper.

77. Sewage-Polluted Water Supplies in Relation to Infant Mortality. By Allan J. McLaughlin. April 26, 1912. 36 pages. 24 charts. Paper. 5 cents. Exhausted.

80. Examination of Excreta for Typhoid Bacilli. By L. L. Lumsden and A. M. Stimson. Report of an Outbreak of Typhoid Fever at Lincoln, Nebr., in 1911. By L. L. Lumsden. May 24, 1912. Paper.

104. Outbreak of Gastro-Enteritis and Typhoid Fever Due to Drinking Water on Excursion Steamer. A report of an investigation of an outbreak of gastro-enteritis and typhoid fever at Clinton, Iowa, and other towns along the Mississippi River among excursionists who had been on a river steamer July 29 and 30. By L. L. Lumsden. November 29, 1912.

111. Typhus Fever and Typhoid Fever. A Report on Papers Read at the Southern Medical Association Meeting at Jacksonville, Fla., November 12-14, 1912. By Joseph Goldberger. January 10, 1913.

126. Water and Ice Supplied by Interstate Carriers. May 16, 1913.

127. Soil Pollution. The Chain Gang as a Possible Disseminator of Intestinal Parasites and Infections. By Ch. Wardell Stiles. May 23, 1913.

128. Typhoid Fever at Albany, N. Y. An Account of the Recent Outbreak Due to Use of Raw Hudson River Water Following Flooding of Filtration Plant. By Theodore Horton. May 23, 1913.

29. Paratyphoid Fever. A Report of an Outbreak in a Hospital at Roanoke, Va. By L. L. Lumsden, A. W. Freeman, and W. B. Foster. May 30, 1913. 5 cents. Exhausted.
31. Sanitation of Flood-Stricken Towns and Cities, with Special Reference to Conditions Observed in River Towns and Cities of Kentucky. By L. L. Lumsden. June 13, 1913.
38. A New Design for a Sanitary Pail. By Victor G. Heiser, July 25, 1913.
54. Flies as Carriers of Lamblia Spores. The Contamination of Food with Human Excreta. By C. W. Stiles and Wm. S. Keister. November 28, 1913.
57. Typhoid Fever and Gastroenteritis. A Report of an Outbreak Among Passengers of the Steamship *Rochester* September-October, 1913. By Hugh de Valin. December 19, 1913.
61. The Wilmington (N. C.) Water Supply. An Investigation Made During November and December, 1913. By Earle B. Phelps. January 9, 1914.
74. An Open Letter. To Owners, Agents, and Masters of Lake and River Vessels. By Rupert Blue. March 20, 1914.
81. The Pollution of Tidal Waters. Its Bearing on Health and the Importance to the State of Its Control. By Hugh S. Cumming. April 10, 1914. 5 cents. Exhausted.
91. Railroad Water Supplies in Minnesota. By R. H. Mullin, H. A. Whittaker, and B. M. Mohler. May 15, 1914.
104. What is a Safe Drinking Water? By Allan J. McLaughlin. June 26, 1914. 5 cents. Exhausted.
113. Safe Ice. By Hugh S. Cumming. August 7, 1914.
114. Studies on the Self-Purification of Streams. By Earle B. Phelps. August 14, 1914.
125. The Chemical Disinfection of Water. By Earle B. Phelps. October 9, 1914.
132. Bacteriological Standard for Drinking Water. The Standard Adopted by the Treasury Department for Drinking Water Supplied to the Public by Common Carriers in Interstate Commerce. November 6, 1914.
147. Sewage Disinfection for Vessels and Railway Coaches. By Leslie C. Frank. January 1, 1915.
161. Hypochlorite Treatment of Water Supplies. Portable Plant and Field Equipment for Its Administration. By H. A. Whittaker. February 26, 1915. 5 cents. Exhausted.
286. Zooparasitic Intestinal Infections. An Analysis of Infections Found Among 1,287 School Children (776 White, 511 Negro) of the City of X. By C. W. Stiles. July 2, 1915.
288. Intestinal Infections. The School Grades Attained by 2,166 White School Children (1,062 Boys, 1,104 Girls) in the City of X, Classified by Age, Sanitation, and Intestinal Parasites. By C. W. Stiles. July 2, 1915.
351. Artificial Purification of Oysters. A Report of Experiments Upon the Purification of Polluted Oysters by Placing Them in Water to Which Calcium Hypochlorite Has Been Added. By William Firth Wells. July 14, 1916.
362. The Sewage Pollution of Streams. Its Relation to the Public Health. By W. H. Frost. September 15, 1916.
368. Drinking Water on Interstate Carriers. A Study of Conditions on Steam Vessels Engaged in Interstate Commerce in the Sanitary District of the Great Lakes. By J. O. Cobb, C. L. Williams, and H. P. Letton. October 13, 1916.
380. Relationship of Milk Supplies to Typhoid Fever. By W. H. Frost. December 1, 1916.
381. Case Fatality in Typhoid Fever. By A. W. Freeman. December 1, 1916.

7. Shower Baths for Country Houses. A Serviceable and Inexpensive Shower Bath Readily Improvised in Town or Country. By Carroll Fox. August 1, 1913. 5 cents.
22. Resolutions Concerning Disposal of Human Excreta at Unsewered Homes. June 18, 1915. 5 cents.
28. Typhoid Fever. A Report of a Water-Borne Outbreak in Decatur and in New Decatur, Ala. By Paul Preble. May 7, 1914. 5 cents.
29. The Transmission of Disease by Flies. By Ernest A. Sweet. April 14, 1916. 5 cents.

O

DR. STANLEY H. OSBORN

TREASURY DEPARTMENT
UNITED STATES PUBLIC HEALTH SERVICE

PUBLIC HEALTH BULLETIN No. 90

OCTOBER, 1917

LIBRARY OF
S. H. OSBORN M.D.

DEC 27 Rec'd
DEC 27 Filed

MENTALITY OF THE ARRIVING IMMIGRANT

NOV 7 - 1937

BY

E. H. MULLAN

Surgeon, United States Public Health Service

PREPARED BY DIRECTION OF THE SURGEON GENERAL

WASHINGTON
GOVERNMENT PRINTING OFFICE
1917

ADDITIONAL COPIES

OF THIS PUBLICATION MAY BE PROCURED FROM
THE SUPERINTENDENT OF DOCUMENTS
GOVERNMENT PRINTING OFFICE
WASHINGTON, D. C.
AT
15 CENTS PER COPY

CONTENTS.

	Page.
Introduction	5
Arithmetical tests	11
Counting	11
Addition	17
Subtraction	23
Division	23
Problems	24
Memory tests (nonarithmetical)	29
Report	29
Visual apprehension	32
Repeating digits	33
Story	35
Cube Test	39
Counting dots	44
Learning	46
Obeying commands	49
Arranging objects	51
Number of months in the year	56
Names of months	56
Number of days in the year	56
Date	57
Number of days in week	58
Names of days in week	58
Name of ship	59
Copying and drawing from memory	59
Transitional tests (nonarithmetical)	73
Enumerating days of week backward	73
Opposites	74
Five animals	76
Inverted animals	77
Colors	78
Coins	79
Weights	79
Difference between house and stable	80
Christmas or Peysach	81
Tests in reasoning (nonarithmetical)	83
Geographic	83
Healy's Construction Test A	93
Relationship	102
Modification	105
Definitions	110
Description	118
Comparative scores of arriving immigrants	125
Points allotted to each test	125
Total scores made by each immigrant tested	126
Discussion	131
Bibliography	132

ILLUSTRATIONS.

Page

Figure 1. "A Village" (taken from illustration, 16 by 11 inches, used in Report Test) 31
2. View of board used in Visual Apprehension Test, with objects fastened to it ..... Facing 32
3. A movement of the Four-Cube Test, showing also how board may be used for Five-Cube Test 40
4. Card used in Dot-Counting Test 45
5. Face of card used in Learning Test 47
6. Back of card used in Learning Test 47
7. Board and field, with 16 pieces, used in Arranging Objects Test 53
8. Geometrical forms used in copying and drawing from memory 60
9. Two standards for each design, used in grading the immigrants' drawings in Copying and Drawing from Memory Test 62
10–39. Drawings made by immigrants in Copying and Drawing from Memory Test 64–79
40. Geographic puzzle, as presented to immigrant for solution 84
41. Geographic puzzle, with first three pieces in their proper clefts 84
42. Geographic puzzle, with pieces in their proper clefts 84
43. Healy Frame Test, as presented to immigrant for solution 94
44. Healy Frame Test, as solved 94
45. A type of error in solving Healy Frame Test 94
46. Arrangement of pieces in Relationship Test 105
47. Pig and chicken—Modification Test 106
48. Pig, chicken, and man—Modification Test 106
49. Two pigs, chicken, and man—Modification Test 107
50. Two pigs, two chickens, and man—Modification Test 107
51. "Last Honors to Bunny" (taken from illustration, 16 by 11 inches in size, used in Description Test) 119

MENTALITY OF THE ARRIVING IMMIGRANT.

By E. H. MULLAN, *Passed Assistant Surgeon, United States Public Health Service.*

INTRODUCTION.

In order to diagnose mental disease and mental deficiency in an immigrant at an immigration station a knowledge of the mental ability and conduct of the normal or average immigrant at the time of arrival is necessary. Normal aliens at the time of landing are in a peculiar mental state. Many of them have come from rural districts where opportunities have been meager; they have parted from their relatives and friends; they have undergone a long voyage, perhaps suffering many hardships; they are anxious to land and to meet relatives. Therefore, their mental condition has been partly shaped by all these circumstances; and if they are questioned or given mental tasks to perform at the time of arrival it is to be expected that their replies and general behavior will not be the same as would be obtained under other conditions.

In order to assist medical officers in understanding the mentality of average immigrants it was decided that an experimental study should be undertaken at Ellis Island and that a number of immigrants who were not obviously mentally deficient or insane should be put through a definite examination to find out what they knew and what they could do under the conditions attending the landing from a long voyage. With this aim in view an examination, composed of questions and performance tests, was carefully planned. Many of the tests had been in use for some time at immigrant stations and had been found serviceable in mental examinations. New tests were also employed, some of which proved to be of distinct value while others were attended with uncertain results.

At first it was intended to examine a large number of immigrants of different nationalities who were free from physical defect, but difficulties made this impossible in a number of cases. It is believed, however, that defects of vision were the only ones which affected the examinations adversely.

An interpreter who spoke Italian, Spanish, and German was assigned to the work. As Italian immigration was large at the time, it was decided to examine as many suitable cases as possible among the German and Spanish immigrants and to fall back on the Italians whenever the others could not be found.

The examination was conducted in a quiet, well-lighted, well-ventilated room on the second floor of the hospital, the subject, interpreter, and examiner being the only ones present. These details must constantly be borne in mind as the results of the tests are considered. As a rule the examination lasted one and a half hours.

After a practice examination with various subjects, which lasted about a week, the examiner and interpreter acquired a definite method of procedure, and the examination proper began about the middle of January, 1914.

The cases for the investigation were selected from those who had been detained at least 24 hours in the detention rooms or from the ambulatory cases of the hospital wards; but care was exercised not to select those who had been detained as suspicious cases of mental deficiency. The experimenter constantly endeavored to select young subjects (over 9 years of age) who had never been to school. A number of such immigrants are hard to find at any one time in the detention rooms of Ellis Island. This is shown by the fact that only 4 illiterate children of 10 and 11 years of age, who could be questioned by the examining interpreter, were found while the examination was in progress. When such cases could not be found, the examiner had to make his choice between young literates and older illiterates. Sometimes he would choose the former and at other times the latter. Among the literates he always selected those who had received the smallest amount of schooling.

Certain immigrants at the time of selection stated that they had never been to school and could not read and write. When the examination was half through or entirely completed, however, many of these cases acknowledged that they had been to school for several months or several years. Their former statements regarding school attendance were immediately corrected, and they were placed in one of the literate groups.

Most of the Hebrew children had been to Cheydar, a religious school in which varying amounts of reading and arithmetic are taught. The statements in regard to the amount of instruction received in these religious schools varied greatly in different cases. As the Cheydar children responded to the tests about as well as the other literate adults, it was thought best to place them among the literate groups.

Owing to the outbreak of the European war, it became difficult to find suitable immigrants for the examination. In September, 1914, it was also felt that enough data had been secured for the purpose of showing how average arriving immigrants respond and behave under the ordeal of a mental examination. Hence the tests were discontinued.

At the conclusion of this study 296 immigrants had been examined. Three of them turned out to be positive cases of mental deficiency.

They were certified for deportation as such, and their records were not included in this exposition. It was thought that 8 other immigrants were possible cases of mental deficiency. As a positive diagnosis could not be made in regard to them at one examination, however, their records were retained. It is believed that this procedure has produced a truer average record than it would had these particular cases been excluded from the results.

The 293 subjects examined and recorded were distributed among the following races:

Italians	103	Greeks	11	Armenian	1
Hebrews	50	Norwegians	4	Cuban	1
Russians	26	Lithuanians	3	Egyptian	1
Ruthenians	26	West India Negroes	3	Irish	1
Spaniards	25	Danes	2	Roumanian	1
Germans	21	Algerian	1	Swiss	1
Poles	11	Arabian	1		

For the purpose of presentation, these immigrants were arranged in two general divisions—literates and illiterates. Those who had been to school for six months or more and those who had learned something about reading and writing at home during a similar period of time were considered as literates. Both literate and illiterate immigrants are divided into three groups according to age. Three special groups, composed of Italians and Slavs—most of whom were over 15 years of age and were therefore classed as adult—and Hebrew children were also formed. The different groups were at times divided into subgroups of the two sexes.

The following table shows how the groups were arranged:.

TABLE 1.—*Groups into which immigrants were divided.*

Literate division.		Illiterate division.	
Number of immigrants.	Group.	Number of immigrants.	Group.
12	Ages 9–11.	4	Ages 10–11.
25	Hebrew, ages 9–11.	8	Ages, 12–14.
37	Ages 12–14.	29	Ages 15 and above.
100	Ages 15 and above.	40	Italian.
		40	Slav.

The composition of these groups, giving the nationality, race, age, sex, and years of schooling of each immigrant, is shown in the final section of the bulletin (pp. 126–130).[1]

Conclusions based on the results obtained in testing the *illiterate 10–11* group, composed of 4 immigrants, 10 and 11 years of age, should not be indiscriminately applied to all illiterate children of those

[1] In this section it will be noted that two immigrants (Russian No. 26 and Austria Ruthenian No. 22) appear in both the *illiterate 12–14* and the *Slav illiterate* groups. This is the only case in which a duplication occurred.

ages. The data presented in regard to this group have some value, especially in the absence of any other data, but the group is entirely too small for the purpose of drawing general conclusions. The same qualification applies in part to some of the other groups.

It will be noticed in the tables of results that the number of immigrants examined in a particular test occasionally fall short of the number that comprise the group. This is due to the fact that in certain cases the examination was discontinued on account of accidental causes.

The tests are divided into two general classes, arithmetical and nonarithmetical. The latter is subdivided into memory tests, transitional tests, and tests in reasoning. A group of immigrants is said to qualify on a test when 75 per cent of its members are successful, but this mark is a purely arbitrary one adopted by the experimenter.

The examination chart which was filled out in the case of each immigrant is here shown:

Examination chart.

No. Name Vision Hearing Gait Stigmata Gen. appearance
Time Where detained Nationality Race Sex Age
Occupation Address in United States

Residence, {Estimation of houses} Church, {No. distance} School, {No. distance}

Railway: Schooling, {Brothers Sisters} Alien, {Tell why you did not go to school?}

Did you learn as easily as {Brothers Sisters} Why are you going to America?

Counting:
- 20 to 1 (T) =
- 2 to 20 (2's. T) =
- 20 to 2 (2's. T) =
- 3 to 30 (3's. T) =

Addition:

3 + 4 =	8 + 6 =	2 + 3 + 4 =
6 + 6 =	15 + 15 =	2 + 4 + 6 + 8 =
6 + 7 =	15 + 16 =	17 + 13 + 9 + 4 =

Cubes:

Three cubes.

Four cubes.
- 1. 4. 2. 3. =
- 1. 3. 4. 2. =
- 1. 3. 2. 4. =
- 4. 2. 3. 1. =
- 3. 2. 4. 1. =
- 2. 4. 1. 3. =

Five cubes.
- 1. 4. 5. 2. 3. =
- 2. 4. 1. 3. 5. =
- 5. 1. 3. 4. 2. =
- 4. 3. 5. 2. 1. =

Subtraction:
- A. 6 apples − 2 apples =
- B. 12 apples − 5 apples =
- C. 20 − (3 bread + 4 meat) (T)[1] =

[1] "T" means that time was recorded.

Modification:

Division: Divide 20 apples equally among 4 persons

Problems:
- How many legs have?
- 1 horse =
- 2 horses =
- 3 horses =

Horse + man + chicken (8. T) =
2 horses + 2 men (12. T) =
3 horses + 2 men (16. T) =
Horse + 2 men + 3 chickens (14. T) =

Visual apprehension: (4″)

Report: (20″)

Narrative	Interrogatory
	Did you see the: 1. Church? 2. Steps? 3. Horse, white? 4. Dog? 5. Man?

Description: 1. Of what is this a picture?
- A. City or village
- B. Butcher shop
- C. Barnyard
- D. Harbor scene
- E. Last Honors to Bunny

E. Last Honors to Bunny:
2. What is going on in the picture?
3. What are the boys and girl doing?
4. What is the big boy doing?
5. Why is he digging a hole?
6. Is he digging a hole in which to bury the rabbit?
7. What is the girl going to do with the flowers?

No.	Copying	Drawing from memory	Arranging objects
Repeating digits:	382 3184 79381	851634 92187432	21763859
	497 1768 27493	147839 13964852	

Obeying commands:

1. Open door 2. Chair near window	1. Book on floor 2. Chair in corner 3. Pencil on chair	1. Pencil on table 2. Close door 3. Book on table 4. Block on floor	1. Block on table 2. Book on floor 3. Open door 4. Chair near window 5. Pencil in corner

Learning Relationship

Geographical

Story

Counting dots

Range of information:

Months		days in the year	date
Days of week		backward	
Christmas	Name of ship		
Colors	coins		weights

Define: 1. Tree 3. Run
2. Bed 4. Truth

"Healy" Difference between home and stable

Pictures of five animals

Opposites:			
	Man	Winter	Rich
	Day	Cold	Sick
	Good	High	Up
	Inside	Yes	Boy

Remarks:

Perhaps as many as 12 immigrants who gave fair responses to tests and questions exhibited extreme peculiarities in behavior which were suggestive of pathological mental states.

Symptoms which occurred in different cases suggested the existence of defective judgment, paranoid trends, manic-depressive, hysterical, and epileptic make-ups, as well as other psychopathic states. Notes were taken in all of these cases but will not be here shown, as they belong more properly to the domain of psychiatry.

Acknowledgments.—The author wishes to thank Dr. August Hoch, of the Psychiatric Institute of the New York State Hospital Service, for certain suggestions which he made at the beginning of the experiment.

The author also wishes to thank Prof. Henry Alford Ruger, Department of Psychology, Teachers College, and Prof. R. S. Woodworth, Department of Psychology, Columbia University, for advising the giving of certain tests and making other suggestions in regard to the examination.

He is indebted to Interpreters Emile Carpentier and Reuben Volovick, of the Immigration Service, for their cooperation. He is also indebted to officers and employees of the Public Health Service, who rendered assistance in many ways.

ARITHMETICAL TESTS.

COUNTING.

The immigrant was tested in counting backward from 20 to 1, forward from 2 to 20 by 2's, backward from 20 to 2 by 2's, and forward from 3 to 30 by 3's. Two trials for each counting test were permitted.

METHOD OF TESTING.

In the 20-to-1 test the interpreter said to the subject, "Count backward from 20 to 1: thus, 20, 19, 18, 17, and so on." Time was taken with stop watch from the instant the immigrant said 20 until he reached 1.

Whenever the immigrant succeeded at the first trial the time required for the performance was immediately recorded on his examination chart. Three or less mistakes[1] were not counted against the immigrant, but if he made more than three, or if he came to a complete stop, the trial was recorded as a failure. The subject was then told to pay strict attention, while the interpreter slowly counted from 20 to 1 three times in succession. After this instruction the subject was again asked to count from 20 to 1, this constituting the second trial.

The other counting tests were conducted in the same way.

RESULTS.

A statement of the results obtained in the 4 counting tests by the 9 groups of immigrants follows. In the 20-to-1 test, which is more frequently used than the other counting tests, the average deviation[2] in the performance time of each group or subgroup is shown.

---

[1] A mistake in counting occurred when the subject injected the wrong number, skipped a number, or when he was assisted by the examiner. The examiner assisted the immigrant whenever the latter did fairly well but accidentally got off the track.

[2] The average deviation is obtained by finding the differences between the individual time records and the average time record in each group of immigrants and then finding the mean of these differences.

TABLE 2.—*Results of counting tests.*

Test.	Group.	Number examined.	Number successful.			Number failing.	Percentages.		Time required for success.				
									First trial.[1]			Second trial.[1]	
			First trial.	Second trial.	Total.		Successes.	Failures.	Average time.	Average deviation.	Time ranged between—	Average time.	Time ranged between—
	Literate:								Secs.	Secs.	Secs.	Secs.	Secs.
	9–11	12	12	....	12	....	100	.....	13	3	6–20	.....	.....
	Hebrew, 9–11	25	24	1	25	....	100	.....	18	6	9–40	[2]105	.....
	12–14	37	36	1	37	....	100	.....	13	3	8–24	[2]30	.....
	15–above	100	99	1	100	....	100	.....	14	2	7–36	[2]26	.....
	Illiterate:												
	10–11	4	2	....	2	2	50	50	19½	3½	[3]16–23	.....	.....
20	12–14	8	7	1	8	....	100	.....	24	10	10–50	[2]63	.....
to	15–above	29	29	....	29	....	100	.....	22	9	7–52	.....	.....
1	Men	21	21	....	21	....	100	.....	22	.....	7–52	.....	.....
	Women	8	8	....	8	....	100	.....	23	.....	13–34	.....	.....
	Italian	40	35	1	36	4	90	10	25	9	10–60	[2]110	.....
	Men	20	19	....	19	1	95	5	22	.....	10–46	.....	.....
	Women	20	16	1	17	3	85	15	29	.....	16–60	[2]110	.....
	Slav	40	31	6	37	3	92½	7½	22	7	10–51	49	30–66
	Men	10	7	3	10	....	100	.....	21	.....	14–36	56	41–66
	Women	30	24	3	27	3	90	10	22	.....	10–51	42	30–62
	Literate:												
	9–11	12	12	....	12	....	100	.....	7	.....	3–15	.....	.....
	Hebrew, 9–11	25	25	....	25	....	100	.....	6	.....	3–13	.....	.....
	12–14	37	36	1	37	....	100	.....	7	.....	3–27	[2]26	.....
	15–above	100	99	1	100	....	100	.....	6	.....	2–27	[2]20	.....
	Illiterate:												
2	10–11	4	2	2	4	....	100	.....	8	.....	[2]6–10	34	[2]33–35
to	12–14	8	8	....	8	....	100	.....	16	.....	5–29	.....	.....
20	15–above	29	26	3	29	....	100	.....	9	.....	4–18	20	14–24
by	Men	21	19	2	21	....	100	.....	8	.....	4–18	18	[2]14–22
2's	Women	8	7	1	8	....	100	.....	10	.....	5–17	[2]24	.....
	Italian	40	36	3	1	....	97½	2½	11	.....	4–45	17	15–22
	Men	20	18	1	19	....	95	5	9	.....	4–20	[2]15	.....
	Women	20	18	2	20	....	100	.....	14	.....	4–45	19	[2]15–22
	Slav	40	36	3	39	1	97½	2½	14	.....	5–26	24	19–32
	Men	10	10	....	10	....	100	.....	15	.....	6–26	.....	.....
	Women	30	26	3	29	1	96⅔	3⅓	13	.....	5–23	24	19–32
	Literate:												
	9–11	12	12	....	12	....	100	.....	12	.....	5–25	.....	.....
	Hebrew, 9–11	25	22	3	25	....	100	.....	14	.....	5–30	28	14–36
	Boys	16	15	1	16	....	100	.....	13	.....	5–25	[2]56	.....
	Girls	9	7	2	9	....	100	.....	15	.....	5–30	14½	[2]14–15
	12–14	37	34	2	36	1	97+	2½+	10	.....	4–23	29	[2]28–30
	Boys	18	17	1	18	....	100	.....	12	.....	6–21	[2]28	.....
	Girls	19	17	1	18	1	94½+	5+	9	.....	4–23	[2]30	.....
	15–above	100	95	4	99	1	99	1	11	.....	4–45	22	17–36
	Men	51	49	2	51	....	100	.....	11	.....	5–45	22½	[2]24–25
20	Women	49	46	2	48	1	98—	2+	10	.....	4–34	21½	[2]17–26
to	Illiterate:												
2	10–11	4	1	....	1	3	25	75	[2]17	.....	.....	.....	.....
by	12–14	8	3	3	6	2	75	25	13	.....	9–13	34	29–40
2's	Boys	4	2	....	2	2	50	50	12½	.....	[2]12–13	.....	.....
	Girls	4	1	3	4	....	100	.....	[2]9	.....	.....	34	29–40
	15–above	29	25	2	27	2	93+	7—	16	.....	6–50	22½	[2]16–28
	Men	21	20	1	21	....	100	.....	15	.....	6–50	[2]27	.....
	Women	8	5	1	6	2	75	25	21	.....	10–30	[2]16	.....
	Italian	40	30	....	30	10	75	25	19	.....	5–50	.....	.....
	Men	20	19	....	19	1	95	5	17	.....	5–50	.....	.....
	Women	20	11	....	11	9	55	45	21	.....	6–43	.....	.....
	Slav	40	28	8	36	4	90	10	22	.....	7–70	33	19–47
	Men	10	7	2	9	1	90	10	21	.....	10–35	43	[2]39–47
	Women	30	21	6	27	3	90	10	22	.....	7–70	29	19–42

[1] Only those who succeeded in the trial are considered. [2] 1 case. [3] 2 cases.

TABLE 2.—*Results of counting tests*—Continued.

Test.	Group.	Number examined.	Number successful.			Number failing.	Percentages.		Time required for success.				
									First trial.			Second trial.	
			First trial.	Second trial.	Third trial.		Successes.	Failures.	Average time.	Average deviation.	Time ranged between—	Average time.	Time ranged between—
									Secs.	Secs.	Secs.	Secs.	Secs.
3 to 30 by 3's	Literate:												
	9–11	12	10	2	12	....	100	.....	21	.....	4–35	[1] 18	.....
	Hebrew, 9–11	25	24	1	25	....	100	.....	19	.....	4–35	[2] 24	.....
	Boys	16	15	1	16	....	100	.....	18	.....	4–35	[2] 24	.....
	Girls	9	9	....	9	....	100	.....	21	.....	7–35	.....	.....
	12–14	37	32	3	35	2	94½+	5+	12	.....	4–22	38	32–45
	Boys	18	15	2	17	1	94—	5½+	11	.....	4–22	41½	38–45
	Girls	19	17	1	18	1	94½+	5+	13	.....	4–22	[2] 32	.....
	15-above	100	87	10	97	3	97	3	12	.....	3–33	29	16–60
	Men	51	45	4	49	2	96+	3½+	12	.....	5–33	41	20–60
	Women	49	42	6	48	1	98—	2+	11	.....	3–27	21	16–25
	Illiterate:												
	10–11	4	2	1	3	1	75	25	21	.....	[1] 12–30	[2] 41	.....
	12–14	8	4	3	7	1	87½	12½	21	.....	15–32	38	22–47
	15-above	29	17	9	26	3	89½	10½	13	.....	6–30	31	11–70
	Men	21	14	6	20	1	95+	5—	12	.....	6–30	25	11–50
	Women	8	3	3	6	2	75	25	20	.....	14–28	45	20–70
	Italian	40	26	5	31	9	77½	22½	19	.....	5–79	22	8–40
	Men	20	16	1	17	3	85	15	17	.....	5–79	[2] 17	.....
	Women	20	10	4	14	6	70	30	22	.....	10–42	24	8–40
	Slav	40	14	21	35	5	87½	12½	25	.....	6–55	32	15–64
	Men	10	7	3	10	....	100	.....	30	.....	10–55	30	25–37
	Women	30	7	18	25	5	83⅓	16⅔	20	.....	6–36	32	15–64

[1] 2 cases. [2] 1 case.

SUMMARY OF RESULTS.

The results of the counting tests in all groups are presented below in combined form:

Counting 20 to 1.—This test was accomplished by all immigrants of the literate groups, all but three succeeding in the first trial. At trial 1 the time ranged from 6 to 40 seconds. The average time in 171 cases was 14½ seconds. Among the literates above the age of 9 the performance of this test was uninfluenced by age.

Of the 121 illiterates 112 succeeded in counting from 20 to 1, 8 of them succeeding at the second trial. At the first trial the time ranged from 7 to 60 seconds. The average time for the first trial in 104 cases was 23 seconds. Two members, or 50 per cent, of the *illiterate 10–11* group were unable to perform this test. The men of the *Slav* and *Italian illiterate* groups slightly excelled the women.

Counting 2 to 20 by 2's.—This test was accomplished by all members of the literate groups. All children under 12 years of age succeeded at trial 1. A Ruthenian boy, age 13, and a Spaniard, age 28, required 2 trials, although both had previously succeeded at the first trial in counting from 20 to 1. At trial 1, the time ranged from 2 to 27 seconds, the average time in 172 cases was 6½ seconds.

Among the illiterates, an Italian man, age 28, who had succeeded in counting from 20 to 1, failed in this test. A Ruthenian girl, age 17, failed on this test as well as on the 20 to 1 test, but succeeded in the two more difficult counting tests. Outside of these two cases all the illiterates, 119 out of 121, succeeded in counting from 2 to 20 by 2's, although 11 of them required 2 trials. At the first trial the time ranged from 4 to 45 seconds. The average time in 108 cases was 11⅛ seconds.

Counting 20 to 2 by 2's.—This test was executed by 172 out of 174 literate immigrants, 9 successful immigrants requiring 2 trials. At the first trial the time ranged from 4 to 45 seconds, the average performance time in 163 cases was 11⅛ seconds.

Among the illiterates 100 out of 121, or 75 per cent of every group with the exception of the *illiterate 10–11* group, succeeded with this test. Ninety-five per cent of the men and only 55 per cent of the women of the *Italian illiterate* group succeeded. Thirteen illiterate immigrants required 2 trials in order to succeed. At the first trial, time ranged from 5 to 70 seconds. The average time in 87 cases was 17⅜ seconds. At the second trial, the time ranged from 16 to 67 seconds, the average time in 13 cases was 30 seconds.

Counting 3 to 30 by 3's.—This test was executed by 169 out of 174 literate immigrants, 16 of them requiring 2 trials. At the first trial the time ranged from 3 to 35 seconds, the average performance time being 16 seconds in 153 cases. At the second trial the time ranged from 16 to 60 seconds, the average performance time being 27¼ seconds in 16 cases.

Among the illiterates 102 out of 121 immigrants succeeded—that is, 75 per cent of every illiterate group succeeded in this test, although only 70 per cent of the Italian women qualified. Above the age of 9, so far as speed and accuracy of performance are concerned, no age difference has been observed. Above the age of 14 the illiterate men made a slightly better showing than the women. Thirty-nine illiterate immigrants, including 21 Slavs and 5 Italians, required 2 trials. At the first trial the time ranged from 5 to 79 seconds, the average time being 20 seconds in 63 cases. At the second trial, the time ranged from 8 to 70 seconds, the average time being 33 seconds in 39 cases.

DISCUSSION.

From the above results it appears that illiterate immigrant children, ages 10 and 11, in a quiet examination room 24 hours after arrival can not be expected to count from 20 to 1 by 2's, or even by 1's. However, after preliminary practice with the other counting tests, they may be expected to count from 3 to 30 by 3's.

The main fault with the experiment is that too few of this particular kind of alien were examined. As above pointed out, it was a

difficult matter to find European children over 9 years of age and under 12 who had not been to school.

The experiment also shows that the illiterate Italian women do not count backward by 2's and do not count forward by 3's so well as the other groups.

The following series show how the immigrant counted in either the first or the second trial. Records which were considered satisfactory because they contained not more than three mistakes are given first. An assist by the examiner, counted as a mistake, is indicated in a series by a number in parentheses. Intervals in the series indicate long pauses on the part of the subjects.

Counting 20 to 1:

20, 19 .... 18, 17 .... 16, 15 .... 14, 13 .... 12, 11, 10, 9, 8, 7, 6, 5, 4, 1.

20 take away 1, 19 take away 1, ... 18, 18 take away 1, 17, 17 take away 1, 16 .... 16 take away 1, 14, 14 take away 1, 13 (and so on down to 1).

20, 19, 19, 18 .... 18, 17 .... 17, 16 .... 16, 15 .... 15, 14 .... 14, 13, 13, 12 (and so on down to 1).

20, 19, 18, 19, 18, 17, 15, 16, 15, 14, 13, 12, 11, 10 (and so on down to 1).

20−1, 19; 19−1, 18; 18, 18−1, 16, (17); 17−1, 16; 16−1, 15 (and so on down to 1).

20 .... 19 .... 18 ... 16 .... 15 .... 14 .... 12 .... 11 .... 9 .... 8, 7 .... 6, 5, 4, 3, 2, 1.

Counting 2 to 20 (by 2's):

2 and 2, 4; 4 and 2, 6; 6 and 2, 8; 8 and 2, 10; (and so on up to 20).

And 2, 4, and 2, 6, and 2, 8, and 2, 10, and 2, 12 (and so on up to 20).

2 and 2, 4, 6, 8, 9, 10 and 2, 12, and 2, 14, 15 (16) and 2, 18, 20.

Counting 20 to 2 (by 2's):

20−2, 18; 18−2, 16; 16−2, 14; 14−2, 12; 12−2 (and so on down to 2).

20−2, 18; 16, 14, 13, (12), 10, 8, 7, (6), 4, 2.

Counting 3 to 3 (by 3's):

3 and 3, 6, and 3, 9, and 3, 12, and 3, 15, and 3, 17 (18), and 3, 21, and 3, 24, and 3, 28, and 3, 30.

6, 6, 9, 9, 12, 12, 15, 17 (18) .... 21, 24, 27.

3, 6, 9, 12, 15, 16 (18), 21, 23 (24), 27, 31.

Each of the following series show 4 mistakes or more. They were therefore scored as failures.

Counting 20 to 1:

20, 19, 17 .... 16, 14, 13, 12, 11, 10, 9, 8, 7, 6, 4, 3, 2, 0.

20−1. 19, 19−1, 17, 18−1, 16, 16−1, 14, 14−1, 13, 13−1, 12, 12−1, 11, 11−1, 12, 11−1, 10, 10−1, 9, 9−1, 8, 7, 6 (and so on down to 1).

20 .... 19 .... 18 .... 19 .... 19 .... 16 .... 15 .... 14 .... 13 .. 14 .... 14 .. (and so on down to 1).

Counting 2 to 20 (by 2's):

2 and 2, 4, and 2, 6, and 2, 7, (8), and 2, 10, 10 and 2, 11, (12), and 2, 13, (14), and 2, 16, and 22, 17, 19, and 2, 21.

Counting 20 to 2 (by 2's):

20−2, 19 (18), 18−2, 16, 16−2, 15 (14), 14−2, 13, 13−2, 11, 11−2, 9, 9−2, 7, 7−2, 4, 4−2, 2, 0.

Counting 3 to 30 (by 3's):

3 and 3, 6, and 3, 8 (9), and 3, 11 (12), and 3, 14, and 3, 17, and 3, 21, and 3, 23, and 3, 26, and 3, 30.

A number of immigrants who had failed to count from 20 to 1, invariably succeeded in counting from 10 to 1.

A number of immigrants who failed in the different counting tests at both trials gave sufficient evidence to show that they possessed real counting ability. Several who failed at the second trial, having made 4 or 5 mistakes, showed marked improvement over their first attempts. In most cases the first trial is really an index as to what numerical relationships the subject has absorbed, while the second trial is often a test in learning.

A number of immigrants, who succeeded after much laborious effort, exclaimed that this was the first time in their lives that they had accomplished such a feat. An important point to remember is that one who accomplishes this task with much effort for the first time may have a better mentality than one who can rattle off quickly a counting series. In the first case it may be an entirely new problem and be solved by purposive thinking. In the second case it may be simply an act of recall by an inferior intellect. This is an excellent example of the necessity of skilled diagnosticians to differentiate and decide upon cases of suspected mental deficiency. No age tests, point scales, or other standards can be trusted in cases of this kind.

Practically all immigrants above the age of 12 can count from 20 to 1. They learn to do this by a process of mental retracing. The ability to count forward in work or play implies that sooner or later the normal mind will see numerical relationships and will be able to count backward. For example, when one immigrant was asked how he had learned to count backward, he replied, "In minding a flock of sheep, several strayed away. This made me count backward." Another said, "One learns counting backward in watching the cattle in the field. I counted backward five years ago." It must be true also that the reversed associative process in counting backward is similarly impressed upon the peasant who sells his farm products or who accidentally breaks his eggs.

Some normal immigrants fail at first on the counting tests, but later succeed. It would seem that the first attempt is preparing them or getting their mental mechanism in form for a successful performance.

In this test or in any other test temporary emotional disturbance may mask real ability on the part of the subject.

All members of the *illiterate 15 and above* group succeeded in counting from 20 to 1 at the first trial, while 3 of them required 2 trials in counting from 2 to 20 by 2's, an obviously easier test. Other peculiar and interesting variations in immigrant psychology are brought out in the above summary.

Counting 2 to 20 by 2's was found to be the easiest counting test; counting 20 to 1 was a little more difficult; while counting 20 to 2 by 2's and 3 to 30 by 3's appear to be the most difficult.[1]

[1] Of the 121 illiterate immigrants, 119 succeeded in counting 2 to 20 by 2's, 112 in counting 20 to 1, 102 in counting 3 to 30 by 3's, and 100 in counting 20 to 2 by 2's.

ADDITION.

The following nine examples in addition were put to each immigrant to be solved mentally. Two trials were allowed for each:

3+4=	8+6=	2+3+4=
6+6=	15+15=	2+4+6+8=
6+7=	15+16=	17+13+9+4=

METHOD OF TESTING.

The interpreter said to the subject, "How many are 3 and 4?" repeating the question immediately. In the event of failure at this first trial, the interpreter again stated the question twice, and the immigrant's response concluded the second trial. This method was used in propounding all nine examples.

RESULTS.

The following table gives the results of these tests:

TABLE 3.—*Results of addition tests.*

Group.	Test.	Number successful.			Number failing.	Percentages.	
		First trial.	Second trial.	Total.		Successes.	Failures.
Literate, ages 9–11 (12 examined)	3+4	11	1	12	.....	100	.....
	6+6	12	.....	12	.....	100	.....
	6+7	10	2	12	.....	100	.....
	8+6	12	.....	12	.....	100	.....
	15+15	12	.....	12	.....	100	.....
	15+16	10	1	11	1	91⅔	8⅓
	2+3+4	11	.....	11	1	91⅔	8⅓
	2+4+6+8	9	3	12	.....	100	.....
	17+13+9+4	6	3	9	3	75	25
Hebrew literate, ages 9–11 (25 examined)	3+4	24	1	25	.....	100	.....
	6+6	25	.....	25	.....	100	.....
	6+7	24	1	25	.....	100	.....
	8+6	22	3	25	.....	100	.....
	15+15	25	.....	25	.....	100	.....
	15+16	24	.....	24	1	96	4
	2+3+4	17	8	25	.....	100	.....
	2+4+6+8	18	5	23	2	92	8
	17+13+9+4	14	5	19	6	76	24
Literate, ages 12–14 (37 examined)	3+4	34	2	36	1	97+	2⅔+
	6+6	36	.....	36	1	97+	2⅔+
	6+7	36	1	37	.....	100	.....
	8+6	36	1	37	.....	100	.....
	15+15	37	.....	37	.....	100	.....
	15+16	34	1	35	2	94⅓+	5+
	2+3+4	30	6	33	1	97+	2⅔+
	Boys (18)	15	2	17	1	94+	5⅔+
	Girls (19)	15	4	19	.....	100	.....
	2+4+6+8	26	8	34	3	91⅓+	8+
	Boys (18)	12	4	16	2	89—	11+
	Girls (19)	14	4	18	1	94⅔+	5 +
	17+13+9+4	21	7	28	9	75⅓+	24 +
	Boys (18)	14	.....	14	4	78—	22 +
	Girls (19)	7	7	14	5	73⅔+	26+

TABLE 3.—*Results of addition tests*—Continued.

Group.	Test.	Number successful.			Number failing.	Percentages.	
		First trial.	Second trial.	Total.		Successes.	Failures.
Literate, ages 15 and above (100 examined).	3+4	97	3	100		100	
	6+6	100		100		100	
	6+7	94	6	100		100	
	8+6	88	9	97	3	97	3
	15+15	98	1	99	1	99	1
	15+16	92	5	97	3	97	3
	2+3+4	76	16	92	8	92	8
	Men (51)	39	7	46	5	90+	9+
	Women (49)	37	9	46	3	93¼+	6+
	2+4+6+8	57	22	79	21	79	21
	Men (51)	29	13	42	9	82+	17+
	Women (49)	28	9	37	12	75½	24½
	17+13+9+4	56	16	72	28	72	28
	Men (51)	31	10	41	10	80+	19+
	Women (49)	25	6	31	18	63+	36+
Illiterate, ages 10–11 (4 examined).	3+4	3	1	4		100	
	6+6	3		3	1	75	25
	6+7	2		2	2	50	50
	8+6	2	1	3	1	75	25
	15+15	2	1	3	1	75	25
	15+16	2		2	2	50	50
	2+3+4	2	1	3	1	75	25
	2+4+6+8	3		3	1	75	25
	17+13+9+4				4		100
Illiterate, ages 12–14 (8 examined).	3+4	8		8		100	
	6+6	8		8		100	
	6+7	5	3	8		100	
	8+6	7	1	8		100	
	15+15	7		7	1	87½	12½
	15+16	7		7	1	87½	12½
	2+3+4	5	2	7	1	87½	12½
	2+4+6+8	4	2	6	2	75	25
	17+13+9+4	1	1	2	6	25	75
Illiterate, ages 15 and above (29 examined).	3+4	26	2	28		100	
	6+6	27	1	28		100	
	6+7	24	2	26	2	93—	7+
	8+6	20	8	28		100	
	15+15	27		27	1	96+	3+
	15+16	26	1	27	1	96+	3+
	2+3+4	20	7	27	1	96+	3+
	Men (20)	14	5	19	1	95	5
	Women (8)	6	2	8		100	
	2+4+6+8	8	12	20	8	71+	28+
	Men (20)	8	8	16	4	80	20
	Women (8)		4	4	4	50	50
	17+13+9+4	7	4	11	17	39+	60+
	Men (20)	5	3	8	12	40	60
	Women (8)	2	1	3	5	37½	62½
Italian illiterate (40 examined, 20 men and 20 women).	3+4	38	2	40		100	
	Men	18	2	20		100	
	Women	20		20		100	
	6+6	38	1	39	1	97½	2½
	Men	19	19		1	95	5
	Women	19	1	20		100	
	6+7	37	1	38	2	95	5
	Men	17	1	18	2	90	10
	Women	20		20		100	
	8+6	31	6	37	3	92½	7½
	Men	13	6	19	1	95	5
	Women	18		18	2	90	10
	15+15	30	4	34	6	85	15
	Men	17	1	18	2	90	10
	Women	13	3	16	4	80	20
	15+16	28	3	31	9	77½	22½
	Men	18		18	2	90	10
	Women	10	3	13	7	65	35
	2+3+4	20	12	32	8	80	20
	Men	10	7	17	3	85	15
	Women	10	5	15	5	75	25
	2+4+6+8	12	9	21	19	52½	47½
	Men	10	5	15	5	75	25
	Women	2	4	6	14	30	70
	17+13+9+4	6	6	12	28	30	70
	Men	6	5	11	9	55	45
	Women		1	1	19	5	95

TABLE 3.—*Results of addition tests*—Continued.

Group.	Test.	Number successful.			Number failing.	Percentages.	
		First trial.	Second trial.	Total.		Successes.	Failures.
Slav illiterate (40 examined, 10 men and 30 women).	3+4	38	2	40	.....	100	.....
	Men	10	.....	10	.....	100	.....
	Women	28	2	30	.....	100	.....
	6+6	40	.....	40	.....	100	.....
	Men	10	.....	10	.....	100	.....
	Women	30	.....	30	.....	100	.....
	6+7	31	7	38	2	95	5
	Men	7	2	9	1	90	10
	Women	24	5	29	1	96⅔	3⅓
	8+6	29	8	37	3	92½	7½
	Men	9	1	10	.....	100	.....
	Women	20	7	27	3	90	10
	15+15	36	2	38	2	95	5
	Men	10	.....	10	.....	100	.....
	Women	26	2	28	2	93⅓	6⅔
	15+16	35	3	38	2	95	5
	Men	10	.....	10	.....	100	.....
	Women	25	3	28	2	93⅓	6⅔
	2+3+4	21	16	37	3	92½	7½
	Men	6	4	10	.....	100	.....
	Women	15	12	27	3	90	10
	2+4+6+8	17	16	33	7	82½	17½
	Men	4	4	8	2	80	20
	Women	13	12	25	5	83⅓	16⅔
	17+13+9+4	7	8	15	25	37½	62½
	Men	3	2	5	5	50	50
	Women	4	6	10	20	33⅓	66⅔

SUMMARY OF RESULTS.

With the exception of the *literate 15 and above* group, 75 per cent of the members of all literate groups succeeded with all the tests in addition.

Only 72 per cent of the members of the *literate 15 and above* group and 73⅓ per cent of the girls of the *literate 12–14* group succeeded in the 17+13+9+4 test. There was little if any trouble with the other tests in addition. The literate children from 9 to 11 years of age excelled their elders.

Among the illiterates less than 75 per cent of some groups succeeded in executing certain tests in addition, as follows:

Ages 10–11: 17+13+9+4, 15+16, 6+7.
Ages 12–14: 17+13+9+4.
Ages 15–above: 17+13+9+4.
Ages 15–above (women): 17+13+9+4, 2+4+6+8.
Italian: 17+13+9+4.
Italian women: 17+13+9+4, 2+4+6+8, 15+16.
Slav: 17+13+9+4.

It must be remembered that in almost every group that failed were to be found individuals who performed every example.

DISCUSSION.

Addition is one of the most useful tests in the mental examination of arriving immigrants. It is employed at the line inspection, at the secondary examination, and in the final certification tests.

In textbooks on experimental psychology simple tests in addition are put down as tests in controlled association. In every combination of digits the mental associative processes bring about a definite result, the sum. Among arriving aliens addition is a test in memory or reasoning, depending upon the character of the example and the previous arithmetical accomplishment of the individual. The series of tests here given are of two kinds. An individual can answer one set by giving forth fixed associations, while the other set can be solved only after associative activity combined with analytic and synthetic thinking. In performing the first set of tests a memory feat is executed. In performing the second set reasoning ability is displayed.

Owing to formal training in school and consequent mathemetical thinking in the practical affairs of every-day life, the literate immigrant has formed many fixed associations in regard to numbers. Hence in answering these questions in addition many literate immigrants reply almost immediately by giving forth their fixed associations—such as 9 and 7 are 16. It is with them a simple matter of recall. On the other hand, the illiterate immigrant may have a few fixed associations composed of unit digits only. He has not had an arithmetical foundation. Hence, when he meets the example 15+15, an example composed of digits above the unit series, he is facing a real problem. Perhaps it is the first time in his life that such a difficult question has been asked him. In order to solve it he must consider the component digits, perhaps breaking up each into smaller digits. He must call upon his limited supply of fixed associations, or in their absence he must use his fingers in computing. He is compelled to retain certain steps in the process and make combinations with these steps. He must keep continually in mind the original numbers and the purpose for which he is working. He will succeed only after much striving, which is often evinced by a long pause, a facial expression of effort, and a sigh of relief when the goal is reached. When he has answered 30 he has accomplished a feat in reasoning. It may be just as difficult for an illiterate to find the sum of 15 and 15 as it is for a literate to find the sum of 17, 13, 9, and 4, the mental processes in the two instances being essentially the same.

It has been possible during the experiment to understand the exact mental process of certain illiterate immigrants because they mumbled the various steps in a low or whispered voice. For example:

In solving 15+15 one said, "20 and 20, 40; take away 5, 35; take away 5, 30, *30*."

In computing 8+6 one said, "8 and 2, 10; 10 and 2, 12; and 2, 14, *14*."

In attempting to solve 17+13+9+4 one immigrant in a whisper handled the first part of the problem this way: "17 and 13, 17 and 13,

17 is 15 and 2, 13 is 5, 5 and 3, 15 20 25 28, *28*." In this case he forgot to add the 2 from his first analysis.

Some other peculiarities in the mental mechanism noticed in this test are of interest and will be mentioned.

In adding 17, 13, 9, and 4 several immigrants forgot to add the 9 and responded by saying 34. Others forgot the 4 and responded by saying 39. A common mistake in adding $2+4+6+8$ was to lose the 6 and reply 14. A number of immigrants who failed to add $15+15$ and $15+16$ succeeded in adding $2+3+4$.

When asked how much are 3 and 4, a bright Norwegian responded 12. He was then asked how many are 3 apples and 4 apples, to which he replied 12. He succeeded in getting all the other additions tests, even getting $17+13+9+4$ with ease. In the first trial he evidently assumed that 3×4 was wanted and held on to this faulty assumption in the second trial. Mistakes are often caused by similar false assumptions on the part of the normal subject.

A number who failed at trial 2 succeeded at a third trial, but the result of such trial was not officially recorded.

Sometimes, after a subject has been doing well, he suddenly begins to do poorly. Some accidental circumstance has occurred or some peculiar motive has influenced his action. In some of these cases it is believed that the immigrant feels that he is in for a long examination and wishes to terminate it by slipshod answers.

As above pointed out all immigrants, even illiterates, have a few fixed associations—that is, they have stored away in their minds the various sums of unit digits and the sums of unit digits taken twice. In other words they will know that 2 and 3 are 5, 4 and 5 are 9, as well as that 7 and 7 are 14, 10 and 10 are 20. Some illiterates have fixed associations established between an odd and even figure, as 9 and 8 are 17. The majority of illiterate immigrants, however, arrive at these last sums by the process of inference, which in this case is really an elementary reasoning process. It may be thus demonstrated in the example of $6+7$:

6+6 is 12.
6+7 is 1 more than 6+6.
Therefore, 6+7 is 13.

Even though excited, it is usually easier for an immigrant who possesses fixed associations to make the correct response in simple sums than to do otherwise.

In these tests some who are unfamiliar with addition immediately grasp the idea as to what is wanted and set about the task by counting on their fingers. These particular individuals have no fixed associations upon which to call, hence they resort to another form of purposive thinking. Some illiterate immigrants, having a limited supply of fixed associations and capable of making inferences therefrom,

resort to counting on their fingers because of a disturbed emotional state at the time of the examination.

The fact that an immigrant, especially if he be an illiterate, has a large number of fixed arithmetical associations—that is, adds readily—augurs well for him, because it shows that his mind has been developing in the past.

It is important to emphasize that often a single examination does not show what the immigrant really knows. At times, in order to ascertain the mental ability along a certain line, two or more examinations have to be made at widely separated intervals. Furthermore, the second part of a single examination often throws true light upon a mental function which the first part failed to show. In this connection may be cited the cases [1] of two Russian children, brother and sister, ages 10 and 11, respectively. Neither they nor their relatives or friends had ever been to school; in fact, there was not a school in the village from which they came. In the adding tests they had difficulty in counting with their fingers. However, 5 minutes later, they did comparatively well with the problems which involved the double process of addition and multiplication. In these cases the examples in addition appear to have prepared them for the more difficult task of problem solving. Both of these immigrants had excellent correlations in the other tests.

Very exceptionally intelligent immigrants who have stood well throughout the examination have no number associations. In striving to obtain the sum of two or three digits these particular individ-

[1] The records of these two cases are given below. A indicates success at first trial, A_2 success at second trial, a numeral the particular wrong reply given, and O a "give up." A semicolon separates records of the first and second trials. In the case of problems the time of performance, in seconds, is indicated.

Russian (male, 10, no schooling):

Addition.

3+4=6; A_2	8+ 6= 0; 900	2+ 3+4=7; 7
6+6. A	15+15=20; A_2	2+ 4+6+8 } not attempted.
6+7=19; 8	15+16=50; O	17+13+9+4 }

Problems (5 minutes later).

How many legs have—?

Horse+man+chicken. A (13 seconds).
2 horses+2 men. A (18 seconds).
3 horses+2 men=12 (33 seconds). A_2 (40 seconds).
Horse+2 men+3 chickens=12 (55) seconds; 12 (35 seconds).

Russian (female, 11, no schooling):

Addition.

3+4. A	8+ 6=13; A_2	2+ 3+4=6; A_2
6+6=10; 13	15+15=25; 27	2+ 4+6+8. A
6+7=10; 14	15+16=O	17+13+9+4=O

Problems (5 minutes later).

How many legs have—?

Horse+man+chicken. A (10 seconds).
2 horses+2 men. A (18 seconds).
2 horses+2 men. A (18 seconds).
3 horses+2 men. A (20 seconds).
Horse+2 men+3 chickens=12 (33 seconds); A_2 (18 seconds)

ials will make a good guess; they will come close even if they do not arrive at the exact sum—that is, they will show good judgment even in their incorrect replies.

From the above discussion it is clear that what is a good response for one immigrant may be a bad response for another of the same age. The classification of every reply depends upon many factors. It depends upon the previous and present physical condition of the subject; upon his emotional state and other psychic states at the time of the examination; upon his race, schooling, training, and other opportunities; upon the examination room, number of times examined, method of examiner, and upon other factors. An immigrant's reply can not be accurately analyzed or graded by a rigid standard. It must be considered and weighed in conjunction with many other factors, and for this the judgment of a trained and experienced diagnostician is needed.

SUBTRACTION.

The interpreter said to each subject: "If from 6 apples 2 apples are taken away, how many remain?" He immediately repeated the question. If the immigrant gave an incorrect answer, the question was again asked twice in the same way.

From the following table it may be seen that 75 per cent of every group was able to subtract 2 concrete objects from 6 and 5 from 12.

TABLE 4.—*Results of subtraction tests.*

Group.	Number examined.	Subtracting 2 apples from 6 apples.						Subtracting 5 apples from 12 apples.					
		Number successful.			Number failing.	Percentages.		Number successful.			Number failing.	Percentages.	
		First trial.	Second trial.	Total.		Successes.	Failures.	First trial.	Second trial.	Total.		Successes.	Failures.
Literate:													
9–11	12	12	.....	12	.....	100	.....	8	4	12	.....	100	.....
Hebrew, 9–11	25	25	.....	25	.....	100	.....	20	5	25	.....	100	.....
12–14	37	37	.....	37	.....	100	.....	28	6	34	3	91½+	8+
15-above	100	100	.....	100	.....	100	.....	88	11	99	1	99	1
Illiterate:													
10–11	4	4	.....	4	.....	100	.....	2	1	3	1	75	25
12–14	8	8	.....	8	.....	100	.....	6	1	7	1	87½	12½
15-above	29	28	1	29	.....	100	.....	25	3	28	1	96½+	3+
Italian	40	36	4	40	.....	100	.....	26	8	34	6	85	15
Men	20	17	3	20	.....	100	.....	18	1	19	1	95	5
Women	20	19	1	20	.....	100	.....	8	7	15	5	75	25
Slav	40	40	.....	40	.....	100	.....	26	9	35	5	87½	12½
Men	10	10	.....	10	.....	100	.....	6	4	10	.....	100	.....
Women	30	30	.....	30	.....	100	.....	20	5	25	5	83⅓	16⅔

DIVISION.

Each immigrant was asked: "If 20 apples are divided equally among 4 persons, how many apples does each person receive?" As in other arithmetical tests, the question was given twice at each of 2 trials. The results follow.

TABLE 5.—*Results of division test (20 apples divided among 4 persons).*

Group.	Number examined.	Number succeeding.			Number failing.	Percentages.	
		First trial.	Second trial.	Total.		Successes.	Failures.
Literate:							
9–11	12	10	2	12		100	
Hebrew, 9–11	25	23	1	24	1	96	4
12–14	37	32	3	35	2	94+	5+
15-above	100	87	9	96	4	96	4
Illiterate:							
10–11	4	3	1	4		100	
12–14	8	6	2	8		100	
15-above	29	25	2	27	2	93 +	6.-
Men	21	21		21		100	
Women	8	4	2	6	2	75	25
Italian	40	32	6	38	2	95	5
Men	20	18	1	19	1	95	5
Women	20	14	5	19	1	95	5
Slav	40	30	5	35	5	87½	12½
Men	10	10		10		100	
Women	30	20	5	25	5	83⅓	16⅔

From this table it may be seen that at least 75 per cent of every group or subgroup succeeded with this test. The two groups, *illiterate 10-11* and *illiterate 12-14*, from whom would be theoretically expected the poorest record, made perfect scores. The test shows that division is a more infrequent arithmetical process among immigrants than either addition or subtraction. In many borderline cases that are hard to dispose of, it is believed that the ability to divide and to know when to divide, shown by repeated demonstrations, favors the supposition that the immigrant subject possesses to a considerable extent the power for abstract thinking.

PROBLEMS.

Each immigrant was asked to solve mentally eight arithmetical problems, seven of which were arranged supposedly in an order of increasing difficulty. Of the problems three were simple and five, involving two fundamental operations, complex. The problems and the order in which they were given are as follows:

(1) If you have 20 cents and you spend 3 cents for bread and 4 cents for meat, how many cents will you have left?

How many legs have—

(2) 1 horse.
(3) 2 horses.
(4) 3 horses.
(5) horse + man + chicken.
(6) 2 horses + 2 men.
(7) 3 horses + 2 men.
(8) horse + 2 men + 3 chickens.

METHOD OF TESTING.

If the subject at first failed to obtain the correct answer, a second trial was given, the interpreter repeating the question at both trials. In the case of problems 1, 5, 6, 7, and 8, time was taken with stop watch from the instant the interpreter said the last word until the

immigrant responded. Sometimes the immigrant questioned the examiner after the problem had been propounded. Such questioning was included in the immigrant's performance time. This was one cause for delay in the solution of the problems.

RESULTS.

The following table gives the results of these tests:

TABLE 6.—*Results of problems.*

Group.	Problem.	Number succeeding.			Number failing.	Percentages.		Time required for success.			
								First trial.[1]		Second trial.[1]	
		First trial.	Second trial.	Total.		Successes.	Failures.	Average time.	Time ranged between—	Average time.	Time ranged between—
								Secs.	*Secs.*	*Secs.*	*Secs.*
Literate, 9–11 (12 examined).	20—(3+4)	5	4	9	3	75	25	22	[2]0–110	20	5–34
	1 horse[3]	12	....	12	....	100	.....	.....	.....	.....	.....
	2 horses	12	....	12	....	100	.....	.....	.....	.....	.....
	3 horses	12	....	12	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	11	1	12	....	100	.....	4	0–15	[4]4	.....
	2 horses+2 men	10	2	12	....	100	.....	6	0–18	[5]10½	[5]2–19
	3 horses+2 men	9	3	12	....	100	.....	10	0–30	5	0–10
	Horse+2 men+3 chickens	10	2	12	....	100	.....	9	0–18	21½	[5]0–43
Hebrew literate, 9–11 (25 examined).	20—(3+4)	22	....	22	3	88	12	5	0–32	.....	.....
	1 horse	25	....	25	....	100	.....	.....	.....	.....	.....
	2 horses	25	....	25	....	100	.....	.....	.....	.....	.....
	3 horses	24	1	25	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	19	6	25	....	100	.....	4	0–14	1½	0–5
	2 horses+2 men	21	4	25	....	100	.....	2½	0–8	5½	3–9
	3 horses+2 men	21	4	25	....	100	.....	4½	0–9	5	1–10
	Horse+2 men+3 chickens	17	7	24	1	96	4	5½	0–14	12	0–24
Literate, 12–14 (37 examined).	20—(3+4)	30	4	34	3	91½+	8+	4	0–24	26½	0–55
	Boys (18)	16	1	17	1	94+	5½+	3	0–24	[5]55	.....
	Girls (19)	14	3	17	2	89+	10½+	5	0–22	17	0–45
	1 horse	37	....	37	....	100	.....	.....	.....	.....	.....
	2 horses	37	....	37	....	100	.....	.....	.....	.....	.....
	3 horses	35	2	37	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	33	3	36	1	97+	2½+	3½	0–20	14	0–22
	2 horses+2 men	28	6	34	3	92−	8+	3½	0–28	9	0–22
	3 horses+2 men	30	6	36	1	97+	2½+	4½	0–22	5	0–20
	Horse+2 men+3 chickens	25	9	34	3	92−	8+	.....	.....	.....	.....
Literate, 15 and above (100 examined).	20—(3+4)	79	16	95	5	95	5	3½	0–50	12	0–72
	Men (51)	43	6	49	2	96+	3½+	5	0–50	6	0–21
	Women (49)	36	10	46	3	94−	6+	2	0–22	16	0–72
	1 horse	100	....	100	....	100	.....	.....	.....	.....	.....
	2 horses	100	....	100	....	100	.....	.....	.....	.....	.....
	3 horses	99	1	100	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	89	10	99	1	99	1	2	0–27	2	0–7
	2 horses+2 men	89	10	99	1	99	1	2	0–8	3½	0–16
	3 horses+2 men	87	12	99	1	99	1	2½	0–11	8	2–27
	Horse+2 men+3 chickens	67	23	90	10	90	10	5	0–24	5	0–20
Illiterate, 10–11 (4 examined).	20—(3+4)	.....	3	3	1	75	25	.....	.....	.....	.....
	1 horse	4	....	4	....	100	.....	.....	.....	.....	.....
	2 horses	4	....	4	....	100	.....	.....	.....	.....	.....
	3 horses	4	....	4	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	4	....	4	....	100	.....	8	0–13	.....	.....
	2 horses+2 men	4	....	4	....	100	.....	13½	2–18	.....	.....
	3 horses+2 men	3	1	4	....	100	.....	14	6–20	[4]40	.....
	Horse+2 men+3 chickens	2	1	3	1	75	25	17	[5]4–30	[4]18	.....

[1] Only those who succeeded in the trial are considered.
[2] "0" stands for "instantaneous."
[3] Problem was: "How many legs have —? "supplying the words given in this table.
[4] 1 case.
[5] 2 cases.

TABLE 6.—*Results of problems*—Continued.

Group.	Problem.	Number succeeding.			Number failing.	Percentages.		Time required for success.			
								First trial.		Second trial.	
		First trial.	Second trial.	Total.		Successes.	Failures.	Average time.	Time ranged between—	Average time.	Time ranged between—
								Secs.	*Secs.*	*Secs.*	*Secs.*
Illiterate, 12-14 (8 examined).	20−(3+4)	2	3	5	3	62½	37½	26	[1] 7–45	24	10-45
	1 horse [5]	8	....	8	....	100	.....	.....	.....	.....	.....
	2 horses	8	....	8	....	100	.....	.....	.....	.....	.....
	3 horses	8	....	8	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	8	....	8	....	100	.....	4	0–12	.....	.....
	2 horses+2 men	6	2	8	....	100	.....	4½	0–8	16	[2] 15-17
	3 horses+2 men	7	....	7	1	87½	12½	11	2–37	.....	.....
	Horse+2 men+3 chickens	5	3	8	....	100	.....	12	5–25	29	4-60
Illiterate, 15 and above (29 examined).	20−(3+4)	17	2	19	10	65½	34½	3	0–14	23	[2] 11-35
	Men (21)	16	1	17	4	81−	19+	3	0–14	[2] 35	.....
	Women (8)	1	1	2	6	25	75	[2] 0	.....	[2] 11	.....
	1 horse	29	....	29	....	100	.....	.....	.....	.....	.....
	2 horses	29	....	29	....	100	.....	.....	.....	.....	.....
	3 horses	25	3	28	1	96½	3½	.....	.....	.....	.....
	Horse+man+chicken	23	5	28	1	96½	3½	3½	0–11	6	2-16
	2 horses+2 men	26	2	28	1	96½	3½	3½	0–15	4½	[2] 3-6
	3 horses+2 men	25	2	27	2	93+	6½+	5	0–21	6½	[2] 1-12
	Horse+2 men+3 chickens	14	11	25	4	86+	13½+	11	0–40	12	0-44
Italian illiterate (40 examined).	20−(3+4)	20	7	27	13	67½	32½	3	0–27	14	0-45
	Men (20)	15	2	17	3	85	15	2	0–27	.....	.....
	Women (20)	5	5	10	10	50	50	5	0–14	9	0-45
	1 horse	40	....	40	....	100	.....	.....	.....	.....	.....
	2 horses	38	2	40	....	100	.....	.....	.....	.....	.....
	3 horses	36	2	38	2	95	5	.....	.....	.....	.....
	Horse+man+chicken	31	7	38	2	95	5	4½	0–15	2	1-5
	2 horses+2 men	30	8	38	2	95	5	4½	0–16	5½	0-15
	3 horses+2 men	31	4	35	5	87½	12½	6½	0–21	5	0-8
	Horse+2 men+3 chickens	18	10	28	12	70	30	7½	0–22	7	2-15
Slav illiterate (40 examined).	20−(3+4)	18	12	30	10	75	25	19	0–75	16	0-43
	Men (10)	5	4	9	1	90	10	18	0–52	17	0-40
	Women (30)	13	8	21	9	70	30	20	0–75	15	0-43
	1 horse	40	....	40	....	100	.....	.....	.....	.....	.....
	2 horses	39	1	40	....	100	.....	.....	.....	.....	.....
	3 horses	36	4	40	....	100	.....	.....	.....	.....	.....
	Horse+man+chicken	38	2	40	....	100	.....	3	0–14	3	[1] 0-6
	2 horses+2 men	37	3	40	....	100	.....	4½	0–18	9	0-18
	3 horses+2 men	30	7	37	3	92½	7½	10½	0–43	13	0-27
	Horse+2 men+3 chickens	19	17	36	4	90	10	15½	0–48	27½	0-80

[1] 2 cases.

[2] 1 case.

SUMMARY OF RESULTS.

Seventy-five per cent of every literate group succeeded in the problem 20−(3+4). The immigrants in the older literate groups excelled those in the younger. The men and boys slightly excelled the girls.

Among the illiterates, 75 per cent of the following groups or subgroups succeeded: *Illiterate 10–11*, men of the *illiterate 15 and above*, men of the *Italian illiterate*, men of the *Slav illiterate*. Less than 75 per cent of the following groups or subgroups succeeded: *Illiterate, 12–14*, women of the *illiterate 15 and above*, women of the *Italian illiterate*,

women of the *Slav illiterate*. Hence the men excelled the women in this test. The women of the Slav illiterate group excelled the other women examined.

The simple leg problems (2–4), which were merely tasks in multiplication, were correctly answered by all literates and illiterates with the exception of 3, a Hebrew girl, age 17, and 2 Italian girls, ages 17 and 19.

The complex leg problems (5–8), involving the double operation of multiplication and addition, were well performed by all literate groups. Among the literate immigrants there were only 22 failures on the four problems. Seventy per cent of the *Italian illiterate* group succeeded on the Horse + 2 men + 3 chickens problem. Seventy-five per cent of the *Italian illiterate* group succeeded on the other three complex leg problems. Seventy-five per cent of all other illiterate groups succeeded in every complex leg problem.

DISCUSSION.

Problems similar to the complex ones used in these tests bring out reasoning ability and are therefore excellent tests to employ in the mental examination of suspected defectives among arriving immigrants.

When a complex problem is presented for mental solution, the sagacity of the normal immigrant enables him to look into the problem, analyze it, and select the proper method for its solution. His arithmetical acquisition then enables him to apply the method. An immigrant, however, may be sagacious—that is, able to select the proper method—but be unable to apply this method, or he may be able to apply a method but not able to select the correct method.

In either case his reasoning ability is at fault. It is believed that sagacity is more often lacking in defective immigrants than is the ability to apply methods. An immigrant may give 12 or 14 as his answer to the problem $20-(3+4)$. If such an answer be given after considerable pause, it may be strongly suspected that the immigrant selected the proper method but made a slight mistake in applying it.

Very often a normal immigrant who possesses both sagacity and learning fails in the solution of a problem because of some interposed factor, such as emotional disturbance. In order to say definitely, therefore, that an immigrant possesses subnormal reasoning ability, failure with problems should occur at successive examinations. Repetition of similar problems will also clear up doubtful points in regard to the subject's reasoning ability.

In the $20-(3+4)$ problem, the illiterate men excelled the women. Perhaps the practical affairs of life outside the home which the men

experience and the emotionalism frequently noticed in women are partly accountable for the differences here exhibited.[1]

The complex leg problems involving the two fundamental operations of multiplication and addition were solved by all but one group, regardless of age, sex, and race. It was frequently noticed in the solution of the leg problems that one or two failures were followed by a succession of correct responses. This indicated that the subject's mind was being gradually prepared for a good performance. In this connection it is important to bear in mind that whenever an attempt is made to find the mental ability along a certain line, a preliminary practice or warming up should be indulged in before the test proper is applied.

[1] The problem 20—(3+4) was the first to be propounded. It is thought that if it had followed the leg problems a much better result with it would have been obtained. It is also thought that if several of such problems had been propounded a better result would have been obtained. If similar problems had been propounded to the same immigrants on the following day no doubt more successful solutions would have been obtained. These suppositions are based upon experience gained in the routine mental examination of arriving immigrants and the fact that in the present test a number who failed at two trials succeeded at a third trial not tabulated above.

MEMORY TESTS (NONARITHMETICAL).

REPORT.

The Report Test [1] is composed of two parts, narrative and interogatory. It was applied by exposing a picture of a village (Fig. 1) o the immigrant for a period of 20 seconds, immediately afterwards etting him to name as many details of the picture as he could recall nd then questioning him in regard to his memory of the picture.

METHOD OF TESTING.

The immigrant was somewhat prepared for the test, as he had ust previously performed the Visual Apprehension Test (see p. 32), vhich was similar in many ways.

The interpreter said to the subject:

The examiner is about to show you a picture, look well at it. Try to remember s many different objects in the picture as you can.

The examiner then exposed the picture to the subject for a period of 20 seconds. As the picture during exposure faced the window, good light was thrown on it in every instance.

Immediately after the exposure the subject mentioned the different details which he had observed. This constituted *the narrative* nd was carefully recorded on the examination chart. The subject vas given plenty of time in which to recall what he had seen.

When the picture had been taken away, the *interrogatory*, in the orm of five questions, was then propounded.

Two of the questions pertained to details that were in the picture. The third question permitted of several answers, while the last two questions referred to details not actually present.

The questions of the interrogatory were as follows:

(1) Did you see the church?
(2) Did you see the steps?
(3) Is the horse white?
(4) Did you see the dog?
(5) Did you see the man?

The replies to these questions, usually in the form of "yes" or "no," were written opposite the questions on the examination chart.

[1] This test is a modified form of the Report Test described in Whipple, Guy Montrose: Manual of Mental and Physical Tests, 1911.

RESULTS.

The results of this test, indicating the number of immigrants recalling a certain number of details, the number giving imaginary

FIG. 1.—"A Village." Taken from illustration, 16 by 11 inches in size, used in Report Test.

details, and the number making correct answers or mistakes in the interrogatory, are shown in the following table:

TABLE 7.—*Results of Report Test.*

Group.	Number examined.	Narrative. Number of aliens recalling different details of picture.												Number of aliens naming imaginary objects.				Interrogatory. Number of aliens making mistakes.			
		14 details.	13 details.	12 details.	11 details.	10 details.	9 details.	8 details.	7 details.	6 details.	5 details.	4 details.	3 details.	1 imaginary object named.	2 imaginary objects named.	3 imaginary objects named.	7 imaginary objects named.	0 mistakes.	1 mistake.	2 mistakes.	3 mistakes.	4 mistakes.
Literate:																						
9–11	12						4		2	3	3			4				2	3	4	3	
Hebrew, 9–11	25					1	4	4	6	6	4			1				2	7	15	1	
12–14—																						
Boys	18	1		2		2	2	3	4	2	2			2					6	8	4	
Girls	19					1	1	4	7	5	1			3				7	4	5	3	
15-above—																						
Men	51			2	3	6	12	8	7	8	4	1		22	2	1		4	20	23	2	2
Women	49		1		4	2	3	13	11	10	4	1						13	18	15	2	1
Illiterate:																						
10–11	4							1	1	1	1							1	1	2		
12–14	8							2	3	3				1				1	3	3	1	
15-above—																						
Men	21					1	4	1	8	4	1	2			1			5	4	9	3	
Women	8					1				4	2	1						3		2	3	
Italian—																						
Men	20				1	4	1	3	5	2	1	3						2	5	6	6	1
Women	20					1		2	7	5	2	1	2		1		3	2	5	12	1	
Slav—																						
Men	10					1			2	4	1	2		4					3	6	1	
Women	30					1	2	4	7	4	7	5		6	3			3	11	9	7	

In the narrative the literate groups made a slightly better showing than the illiterates. Thirteen literate immigrants enumerated more than 10 details, while only 1 illiterate immigrant recalled more than 10 details. A number of immigrants injected imaginary objects into their narratives.

The best scores were made by 1 boy of the *literate 12–14* group, who scored 14 details, and by a woman of the *literate 15 and above* group, who scored 13 details. Two boys of the *literate 12–14* group and 2 men of the *literate 15 and above* group each scored 12 details.

The most striking fact learned from the interrogatory was that the majority of immigrants made mistakes in answering some of the 5 questions. Among the literates only 28 answered all 5 questions correctly and among the illiterates only 7.

DISCUSSION.

Memory tests are legion, but they differ from one another in various respects. This test, in the main, may be classed as a test of recent memory. In instructing the subject in regard to this test and exposing the picture to him we see how his mind functionates in certain directions. Before the new picture is shown, the normal subject, of course, has his own store of images and fixed associations which will be of some assistance to him in performing the test.

Such combinations as rooster-hens, house-church, trees-grass-flowers, and similar series, are associations common to all. In order to succeed in this, as well as in other memory tests, the subject first of all must attend. While attending, he must make a number of distinct perceptions of the details of the picture before him. He then sees the connection between one percept and another. He forms certain associations between the various objects depicted. Perhaps he holds in consciousness the auditory-word-images which are symbols of the details. He may even articulate such words to himself. During the mental process he is said to be fixing or retaining the details. The process may not go on in the exact order here described, or the various phases may take place almost simultaneously, or the act of attending may itself be accompanied by all of these phases combined; but something similar to this process does take place.

Another factor is personal interest, which will cause the subject to select and retain certain details to the exclusion of others.

When the immigrant is asked by the examiner to recall what he has retained, by reverse associative processes the retained images are serially brought into consciousness and expressed to the examiner in the form of suitable words.

Perhaps the most striking results of this test at the first examination among arriving immigrants were the very poor showing which was made and the fact that some of the brightest among them scored the smallest number of points.[1] When the Report Test, however, was applied for a second time to several immigrants, each one enumerated more details than he had at the first trial. The present investigation thus indicates that this test can be made serviceable in diagnostic work by repeating it, with the same or different pictures. After the subject has enumerated 6 or 8 details at the first trial he could be told that there are many others which could have been mentioned. A second trial would then throw some light on his learning power, and for this purpose the test could even be given a third time. Care must be exercised in selecting for the second trial, or even for the test proper, pictures the details of which are familiar to immigrants.

VISUAL APPREHENSION.

This test consisted in exposing a board containing 10 objects to the immigrant's view for a brief period and immediately recording the objects which he had seen.

The immigrant was first prepared for the test by exposing to his view for a brief period a box containing a number of trinkets and

[1] It is thought that the mentally deficient immigrant would do almost as well as the normal on this particular test at the first trial.

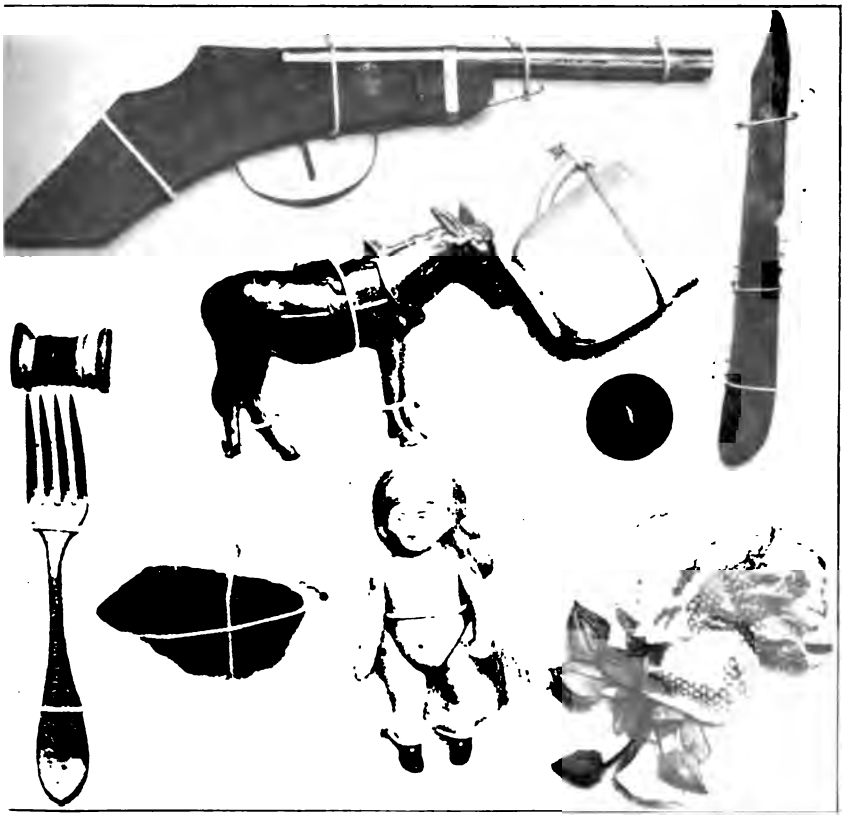


FIG. 2.—View of board used in Visual Apprehension Test, with objects fastened to it.

having him recall them. After this performance the interpreter said:

I will now expose for a period of four seconds a board containing a number of objects, and I want to see how many of them you can recall, so look well.

A board containing 10 objects (fig. 2) was then exposed for 4 seconds, immediately after which the subject enumerated the objects he had perceived.

The following table gives the results:

TABLE 8.—*Results of Visual Apprehension Test.*

Group.	Number examined.	Number of aliens recalling different objects in test.										Number of aliens recalling imaginary objects.			
		9 objects.	8 objects.	7 objects.	6 objects.	5 objects.	4 objects.	3 objects.	2 objects.	1 object.	0 object.	1 object.	2 objects.	3 objects.	5 objects.
Literate:															
9–11	12	....	2	1	1	1	2	2	....	2	1	2	.....	.....	.....
Hebrew 9–11	25	....	.....	.....	5	6	7	5	1	1	....	5	2	1	.....
12–14—															
Boys	18	....	.....	.....	3	4	8	1	1	1	....	6	2	.....	.....
Girls	19	....	.....	1	4	5	4	4	1	.....	.....	6	.....	1	.....
15-above—															
Men	51	1	1	4	9	9	14	8	2	3	....	9	3	2	.....
Women	49	....	2	4	6	14	10	10	3	.....	.....	13	3	.....	1
Illiterate:															
10–11	4	....	.....	.....	.....	.....	2	1	1	.....	.....	.....	.....	.....	.....
12–14	8	....	.....	1	1	1	4	.....	.....	1	....	2	1	.....	.....
15-above—															
Men	21	....	.....	2	6	4	4	1	1	3	....	3	.....	1	.....
Women	8	....	.....	1	1	1	....	3	1	....	1	1	.....	.....	.....
Italian—															
Men	20	....	.....	3	4	5	5	....	2	.....	.....	4	1	.....	.....
Women	20	1	.....	.....	5	4	1	7	2	.....	.....	3	3	1	.....
Slav—															
Men	10	....	1	1	....	2	4	1	1	.....	....	3	1	.....	.....
Women	30	....	.....	1	4	11	7	4	2	1	....	7	1	.....	.....

The only statement that will be made in regard to the test is that many intelligent immigrants, as shown by their excellent correlations in other tests, enumerated only 2 or 3 objects, while many less intelligent ones enumerated 5 or 6 objects.

REPEATING DIGITS.

The immigrants were tested as to the number of digits they could repeat in the exact order in which given.

The following numbers were used in this experiment: 382, 497; 3184, 1768; 79381, 27493; 851634, 147839; 9218743, 1396485; 21763859.

METHOD OF TESTING.

The immigrant was first tested with numbers of three digits. As soon as he succeeded in repeating a given series of digits he was tested with the next higher series, different digits or a different order being used at each trial. Four trials were allowed to repeat any given number of digits.

At the first trial the interpreter would pronounce each digit slowly, allowing the same period of time to intervene between the pronunciation of each digit. This might be represented as follows:

7 9 3 8 1

In the event of failure, the interpreter would give the same number but in a reverse order, pronouncing it rapidly in two parts (second trial), thus:

18 397

The interpreter would give the third trial by separating the test number into another two-part arrangement and by pronouncing it rapidly, thus:

274 93

In the event of failure, the interpreter would give the last trial by articulating the number in three distinct parts, thus:

39 47 2

RESULTS.

Every effort was made to see if the subject could repeat at least five digits. Those who repeated five or more and those who repeated less than five are shown in the following table of results, with the percentage of those who succeeded:

TABLE 9.—*Results of Repeating Digits Test.*

Group.	Number examined.	Number of aliens repeating different numbers or series of digits.						Percentage who repeated 5 digits or more.
		5 or more digits.				4 or less digits.		
		8 digits.	7 digits.	6 digits.	5 digits.	4 digits.	3 digits.	
Literate:								
9–11	12	1	5	1	4	1	.....	91
Hebrew 9–11	25	6	7	8	3	1	.....	96
12–14	[1] 36	3	13	11	8	1	.....	97+
15-above—								
Men	50	4	13	18	9	5	1	88
Women	[1] 47	9	10	16	10	2	.....	95+
Illiterate:								
10–11	4	.....	.....	1	2	1	.....	75
12–14	8	.....	2	4	1	1	.....	87
15-above—								
Men	21	1	3	4	11	2	.....	90
Women	8	.....	.....	3	3	2	.....	75
Italian—								
Men	20	.....	.....	6	9	5	.....	75
Women	[1] 19	.....	2	4	4	8	1	53+
Slav—								
Men	10	1	.....	3	4	2	.....	80
Women	30	1	4	5	13	7	.....	76

[1] Number recorded is given.

SUMMARY OF RESULTS.

Seventy-five per cent of all the groups were able to repeat at least 5 digits.

The women of the *Italian illiterate* group constituted the only subgroup which fell below the 75 per cent mark.

The ability to repeat digits was more marked amohg the literates than among the illiterates.

Among the illiterates the men slightly excelled the women in their ability to repeat at least 5 digits.

Above the age of 9, there is practically no age difference in the ability to perform this test in arriving immigrants.

DISCUSSION.

This test is classified as one of rote memory. Familiarity with digits is certainly a necessary requisite in order to perform it well. A subject who has never been to school and who seldom uses figures is handicapped in its performance. It has been the experience of those examining arriving immigrants to see subjects who could not repeat 5 digits, but who could repeat the names of 5 objects in the exact order in which they were pronounced by the examiner.

Practice in this as well as in other tests at times enables an immigrant to improve his score. Those who could only repeat 4 digits upon arrival have been found to repeat 5 or 6 digits at a second or third examination.

In many foreign languages each digit is composed of two or more syllables. Consequently we would expect a comparatively poor showing in this test among non-English speaking aliens. There are 2, 3, and 4 syllables in the Lithuanian digits and we find a correspondingly poor showing among them in the test. It has been observed that English-speaking immigrants, as a rule, can repeat 7 digits.

STORY.

The Story Test consisted in the immigrant telling a story after it had twice been read to him. The Lincoln pig story,[1] with "the king" substituted for Mr. Lincoln, was used in this experiment in order to test the immigrant's logical memory or his memory for sequence and related ideas. It was also thought that other interesting facts in connection with immigrant psychology would be brought out by such a test.

The story was as follows:

One day the king was out riding. As he passed along the road, he saw a pig sinking into a mudhole. Poor piggy would climb part way up the slippery bank, then down he would fall again. "I suppose I should get down and help that pig," thought the king, "but I have on my new suit, and it will be quite spoiled if I do so. I think I will let him get out the best way he can." He rode on. When nearly 2 miles away, he turned and came back. Not minding the new clothes, he stooped, and taking piggy in his arms, he dragged him out of the mud. The new suit was quite spoiled, but the king said he had taken a pain out of his mind.

[1] Given in Clyde and Wallace: Through the Year, book 2. This story was used in preference to other stories because the average peasant is acquainted with the different details that make up the story.

METHOD OF TESTING.

The interpreter informed the subject that he was to listen attentively so that he could recall as much of the story as possible. The interpreter then read the story slowly twice in succession. At the conclusion of the second reading, the immigrant recited the story in his own language. The interpreter immediately translated it, idea by idea, and the examiner quickly wrote the reproduction on the immigrant's examination chart.

For the purpose of grading, the story was divided into the following ideas, each of which was valued at one point:

1. King out riding—horseback.
2. Pig in mudhole—mud—hole—water hole.
3. Climb up and fall back—trying to get out—save himself.
4. Like to help pig—save pig.
5. New suit.
6. Will be spoiled—it will be dirtied—does not like to dirty clothes.
7. Let him get out best way he can—let him save himself—leave him alone.
8. He rode on—continued his journey—kept on his way.
9. Two miles.
10. Returned.
11. Not minding clothes.
12. Pig in arms.
13. Dragged him out—rescued him—saved it.
14. Suit spoiled—covered with mud—all dirtied.
15. King said.
16. Took pain out of mind—feel easier in mind—weight from my mind—took a thought out of my mind—took a weight out of my head—weight off my shoulders.

In addition to one point for each of these 16 ideas, 4 points were allowed whenever the essential theme—"dragged the pig out of the mud and took a pain out of his mind"—was expressed. Whenever the subject mentioned an idea that was not expressed but was implied in the original story, it was not counted against him; but if two such implications occurred, one point was subtracted from his total score. One point was subtracted for each false idea. Minus quantities were not used (1 − 3 being scored as 0). A perfect story would therefore be represented by the equation:

$$16+4-0=20.$$

These rules were followed as closely as possible, and even then it is conceded that some stories were hard to grade accurately. It is believed, however, that on the whole the total score in each case is a fair representation of what was accomplished.

SPECIMENS OF IMMIGRANTS' REPRODUCTIONS.

Specimen reproductions are given below, each one being chosen to bring out different points of psychological interest. A perpendicular line follows each correct idea; a colon follows each idea that is false

or imaginary; and a colon with the figure one-half (:½) follows the expression of an idea which was merely implied in the original story. The stories are given in the exact words of the interpreter, who was advised to give as literal a translation as possible.

The king once went horseback riding | in the road he saw a pig in a mud hole | at first he thought of helping the pig | and looked at his good clothes | and went on | he rode on for 2 miles | and returned | didn't look at his new clothes | but took the pig in his arms | pulled it out | although he soiled his clothes | he felt easier in his mind | . (Russian No. 10. *Score*, 12+4−0=16.)

The king was riding | the pig was in the mud hole | he wanted to save it | but he did not want to soil his clothes | he rode on for 2 miles | and returned | he didn't look at his clothes | dragged the pig out | soiled his clothes | when he rode farther on (:½) he felt easier in his mind | . (Ruthenian No. 21. *Score*, 10+4−0=14.)

The pig that was in the mud hole—and the man who was there with the pig and the chickens (:). (Spanish No. 13. *Score*, 1+0−1=0.)

The king was going for a ride | and he saw a pig, the pig slid and fell into the hole | the king said "I ought to get him out" | but my clothes are new | then the king got him out of the hole | and spoilt his clothes | that's all. (Syrian Arabian No. 1. *Score*, 6+0−0=6.)

I don't understand. You are reading something about a Christian and animal on the earth. (Spanish No. 18. *Score*, 0+0−0=0.)

The king who had been out riding | loaned himself in going to save that poor pig | that was floundering in the mud | the pig showed its thankfulness to the king for having saved his life (:) the king said "it is all right (:) it is the grace of God I have come to get you out (:)." (Spanish No. 7. *Score*, 3+0−3=0.)

There was once a king and there was a pig and he scratched up his legs (:) and he was wallowing in the mud | after that he jumped in the mud (:) after 2 miles | he returned | he caught him up and threw him in the mud (:) then his clothes were completely covered with mud | . (Italian No. 77. *Score*, 4+0−3=1.)

One day a king was out riding on horseback | he saw a pig in a mud hole | he said he would try to take him out but | that he had a good suit of clothes | he said he rode up the road 2 miles | he turned back again | on his way back he saw the pig trying to get out of the mud hole (:½) he came down off his horse (:½) took the pig out of the mud hole | dirtied his new suit of clothes | he had a pain(:) that is all I know. (Irish No. 1. *Score*, 10+0−2=8.)

Pig fell down the hole when he tried to get up again. (Norway No. 4. *Score*, 1+0−0=1.)

One day there was a gentleman, a king on horseback | he saw a pig while passing on the roadside who was in a well filled with mud | he wanted to save the pig | but he had on his Sunday clothes | and he did not want to dirty them | he then went off | 2 miles | and returned | in order to save the pig he took him out | and he dirtied his suit | and he took it with him (:). (Italian No. 68. *Score*, 10+0−1=9.)

A man was riding horseback | while through the woods he met a pig, he went after that 2 miles distant | he returned and pulled the pig out | with his hands | saying that it weighed very much (:) he ruined his suit | I don't remember any more, I would understand it better if it were in Greek. (Spoke in French.) (Greek No. 1. *Score*, 5+0−1=4.)

This man was afraid that the poor animal would die in that place (:) quickness he thought of his new suit and the pig he would not mind to save. He saved the pig's life | but I do not know whether he did this for his own sake or on account of the value of the pig. If he would keep it. It might have been that he saved the pig for its own sake or also for the sake of him who pulled him out. (Spaniard No. 1. *Score*, 1+0−1=0.)

The king was doing it (:) He was digging a piece of beans. (Italian No. 38. *Score*, 0+0−2=0.

The king, dirtying clothes | 100 meters (:) he came back. (Note: Much straining and difficulty in finding suitable words with which to express himself.) (Italian No. 34. *Score*, 1+0−1=0.)

The king came on horseback | saw the pig in the mud that was drowning | he then got down pulled the pig out | in his arms | and saved the pig's life like a good Christian (:) (Italian No. 33. *Score*, 4+0−1=3.)

One day the king was passing in the road, he met a pig in mudhole | trying to get out with his feet | pig wants help (:½) king answers (:) how can I help you? (:) I have new suit | the king went away | pig continued to demand help (:) the king after going a distance of 2 miles | he says I don't care if I have a new suit I am going to help that poor pig (:½) the king's new suit was covered with mud | that's all. (Italian No. 19. *Score*, 6+0−3=3.)

RESULTS.

The results of this test were as follows:

TABLE 10.—*Results of Story Test.*

Group.	Number examined.	Number scoring 15 points or more.					Number scoring from 10 to 14 points.					Number scoring less than 10 points.									
		19 points.	18 points.	17 points.	16 points.	15 points.	14 points.	13 points.	12 points.	11 points.	10 points.	9 points.	8 points.	7 points.	6 points.	5 points.	4 points.	3 points.	2 points.	1 point.	0 points.
Literate:																					
9–11	12			1	1	2	1	1			1			2		1		1			1
Hebrew 9–11	25		3	3	6	5	1	3	1	1	1	1									
12–14	37	1	1	3	4	6	2	1			1	2		1	2	2		1	4	1	5
15-above	[1]97	1	4	6	14	7	10	10	5	3	3	2	2	4	5	2	2	6	3	4	4
Illiterate:																					
10–11	4								1		2						1				
12–14	8				2		1			1		2								1	1
15-above	[1]26				1	1	3		1		1	1	5	1	3	1	1	3	2		2
Italian—																					
Men	20			1		1	1	1				1	1	1	1	2	1	4		3	2
Women	[1]19				1						1		1	2		2	1		1	3	7
Slav—																					
Men	10				2	2	2	1			1	2									
Women	30				3	4	8	1	3	1	1	4	1		1			1			2

[1] Number recorded.

SUMMARY OF RESULTS.

The literate groups excelled the illiterate in this test. The children of the *Hebrew literate 9–11* group made the best record. Seventeen out of 25 of them scored 15 points or more; 7 scored between 10 and 14 points; and only 1, who made 9 points, fell into the lowest section. It will be noted that 10 literate immigrants considered normal scored nothing.

Among the illiterates, 8 men and 21 women of the *Slav illiterate* group scored 10 points or more, while only 4 men and 2 women of the *Italian illiterate* group made 10 points or more. A number of the low records in the *illiterate 15 and above* group were made by Spanlards and Italians. Fourteen illiterates, 7 of whom were Italian women, scored 0 points.

Above the age of 9, the ability to render this story appears to be uninfluenced by age.

DISCUSSION.

This is undoubtedly a severe test and requires a higher degree of sustained attention than many other tests. In order to make a fair showing with it, the subject must be in a cooperating mood and not emotionally disturbed. Furthermore, among other requisites there must be fertility and control of language. It must be remembered also that one who has read stories, who has heard stories told, or who has lived in a "story atmosphere" is better able to cope with a test of this kind than one who has not had such advantages. Briefly, it may be said that the poor records obtained in this test were due to lack of experience, unfamiliarity with stories, and defects in the emotional field. Many of the narratives, especially by the members of the illiterate groups, showed a good deal of emotional coloring and contained erroneous ideas. In some cases of complete failure the alien temporarily assumed the "give up" attitude, which is best understood by such phrases as "What's the use?" "Too much for me," "I am tired of playing." In other words, in these particular cases there existed a feeling of discouragement which resulted in a complete lack of cooperation.

Many immigrants who made a low score on this test made excellent records on other tests and they impressed the examiner as being normal or average immigrants. Thus, while the rendering of a good story on the part of an immigrant is indicative of a good mental mechanism, the rendering of a poor story does not necessarily denote mental enfeeblement.

CUBE TEST.

The Cube Test, devised by Knox, of the Public Health Service, consists in the examiner touching four or five different cubes one after another in a definite order, immediately after which the subject strives to touch the same cubes in the same order.

METHOD OF TESTING.

In touching the cubes a spool was used instead of a block, so as to draw the subject's attention from the exact way in which the cubes were struck and to the essential feature of the problem, the order in which the different cubes were touched by the examiner. A board containing openings for five cubes was used in this experiment.

In figure 3 four cubes are represented. In the movement here depicted the examiner touches the cubes in the following order, 14 23, the space representing a pause of one and one-half to two seconds. As the test was carried out, immediately the subject succeeded with one movement, the examiner gave him another one,

touching the blocks in a different order. The following movements were used in the Four-Cube Test, the space indicating an interval of from one and one-half to two seconds:

First: 14 23	Third: 13 24	Fifth: 32 41
Second: 13 42	Fourth: 42 31	Sixth: 24 13

The execution of these six movements by examiner and subject ordinarily required from 40 to 60 seconds.

The following four movements were used in the Five-Cube Test:

First: 145 23	Third: 513 42
Second: 24 135	Fourth: 435 21

The only case in which two trials were allowed was in the first movement of the Four-Cube Test. This was done because many

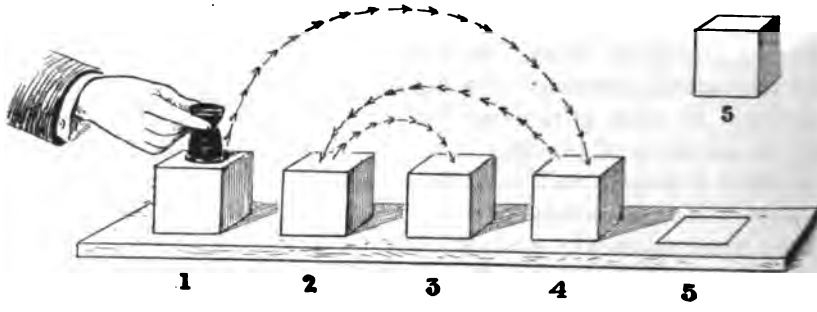


FIG. 3.—A movement of the Four-Cube Test, showing also how board may be used for Five-Cube Test.

immigrants did not at first understand what was wanted of them. In touching the blocks the examiner always moved slowly; furthermore, time to recover mentally from each movement was allowed the subject, especially if he were laboring under some kind of stress and performing the test with tremor and uncertainty. In spite of the fact that the test was performed early in the examination of each immigrant, after 10 to 20 minutes had been spent on other tests, several subjects were emotionally disturbed. In these cases this particular test was deferred to the end of the examination.

When a wrong movement was made but immediately rectified, it was recorded as a success.

RESULTS.

The results of these Cube Tests are given below:

TABLE 11.—*Results of Cube Tests.*

Group.	Number examined.	Four cube.										Five cube.							
		Number performing 4 movements or more.				Percentage.	Number performing less than 4 movements.				Percentage.	Number performing 1 or more movements.					Percentage.	Number performing no movements.	Percentage.
		6 movements.	5 movements.	4 movements.	Total.		3 movements.	2 movements.	1 movement.	Total.		4 movements.	3 movements.	2 movements.	1 movement.	Total.			
Literate:																			
9–11	12	5	2	2	9	75	2	1	...	3	25	3	2	4	3	12	100	...	.....
Hebrew, 9–11	25	11	6	4	21	84	2	2	...	4	16	2	5	8	8	23	92	2	8
12–14—																			
Boys	18	7	10	1	18	100	...	...	...	...	.....	4	8	1	2	15	83½	3	16⅔
Girls	19	4	8	2	14	73½+	2	2	1	5	26+	4	3	3	3	13	68+	6	31½+
15-above—																			
Men	51	20	20	5	45	88+	2	2	2	6	11½+	8	11	14	9	42	82+	9	17½+
Women	49	17	19	8	44	89½+	3	2	...	5	10+	5	11	14	14	44	89½+	5	10+
Illiterate:																			
10–11	4	2	2	...	4	100	...	...	...	...	.....	...	1	1	2	4	100	...	.....
12–14	8	1	2	4	7	87½	1	...	...	1	12½	1	...	1	4	6	75	2	25
15-above—																			
Men	21	5	4	8	17	81−	4	...	...	4	19+	4	2	6	6	18	85⅞+	3	14+
Women	8	1	4	1	6	75	1	1	...	2	25	1	1	1	4	7	87½	1	12½
Italian—																			
Men	20	7	10	2	19	95	1	...	...	1	5	3	6	4	6	19	95	1	5
Women	20	2	7	8	17	85	2	1	...	3	15	1	4	4	4	13	65	7	35
Slav—																			
Men	10	5	2	1	8	80	2	...	...	2	10	...	...	2	6	8	80	2	10
Women	30	8	10	5	23	76⅔	4	2	1	7	23⅓	2	4	6	10	22	73⅓	8	26⅔

SUMMARY OF RESULTS.

In the Four-Cube Test, 75 per cent of all literate immigrants succeeded in correctly executing 4 out of the 6 movements. The girls of the *literate 12–14* group fell a little below the 75 per cent mark, while the boys of the same group made the best record (100 per cent). This is the only group among the literates which shows a difference in performance as regards sex. Many of the young children, especially in the *Hebrew literate* group, excelled the older immigrants in this test.

In the Four-Cube Test the 4 children of the *illiterate 10–11* group succeeded in doing 4 movements or better. In fact they did as well as any other immigrants, regardless of schooling. Seventy-five per cent of all the immigrants of the illiterate groups succeeded in performing at least 4 movements. The men seem to execute the test correctly more often than the women. The Italians, both men and women, excel the Slavs.

In the Five-Cube Test, 75 per cent of all the literate groups combined succeeded in accomplishing at least 1 out of 4 movements. The only subgroup falling below the 75 per cent mark was that of the girls of the *literate 12–14* group.

In the Five-Cube Test, 75 per cent of all the illiterates succeeded in scoring 1 out of 4 movements. The Slav women did not quite succeed in making the satisfactory mark of 75 per cent. The percentage of success among the women of the *Italian illiterate* group fell to 65.

Although the difference exhibited in the various groups are interesting from a psychological standpoint, yet they are of little importance when a diagnosis of mental deficiency is under consideration.

CONCLUSIONS.

From the above table and summary of results it may be concluded that—

1. When the test is conducted 24 hours after arrival, in a quiet room, and after several minutes of preliminary questioning, a normal arriving immigrant above the age of 9 may be expected to execute 4 out of 6 movements with the Four-Cube Test.
2. This test is uninfluenced by formal schooling.
3. Above 9 years of age, for practical purposes, there is little or no difference in the performance of this test as regards age, sex, and nationality.
4. On the whole, 75 per cent of all immigrants succeed in scoring at least 1 movement out of 4 with the Five-Cube Test, although a few individual groups are unable to qualify in this test.

DISCUSSION.

The Cube Test is perhaps the most useful performance test yet devised in the mental examination of arriving immigrants. As the test can be quickly executed, it is especially valuable at the secondary inspection or weeding-out process, where the medical officer inspects a large crowd of immigrants for the purpose of selecting those suspected of having mental defects. It is also of value in subsequent examinations, where it becomes, in addition to its other functions, a test in learning. In the Four-Cube Test the subject's mentation is put on parade, so to speak. During the performance the subject is carefully observed. His general get-up, facial expression, amount of self-reliance, power of comprehension, manner of performing test, muscular control, rapidity of movement, attention over a period of 45 seconds, emotional state, as well as accuracy of performance are all taken in. The fourth movement brings out his ability to resist suggestion.

In these tests most of the immigrants who succeeded in only two or three movements with the Four-Cube Test were tried again at the

conclusion of the entire examination. This secondary testing almost invariably resulted in an improvement over the first examination. A normal person acquires the knack of performing the experiment. The knack for one person may be simply to remember which cube is struck first; for another person it may be to remember which two cubes are struck first. Hence, from day to day, in repeated mental examinations with the Cube Test, an improvement in the performance of the test should occur at each examination. In cases where only one or two movements were scored in the Four-Cube Test, and where the general examination of the subject was up to the average, the examiner could predict with almost certainty that the subject would make a perfect score in this test if given another opportunity.

Transient causes sometimes temporarily prevent the performance of the test by persons of real ability. Wandering of the attention from one cause or another is frequently productive of failure. A bright Italian boy did only three movements with the Four-Cube Test and then made a perfect score on the Five-Cube Test. A number of similar cases have occurred during the experiment. In other cases, failure at the start may indicate that the subject does not comprehend what is wanted of him; failure toward the end would be suggestive of lack of attention or fatigue.

This test naturally requires a fair degree of vision.

Many adult immigrants who have had considerable schooling do the test poorly, while many young illiterates perform it well. In fact, two immigrants who had been to school for seven and nine years, respectively, did the Cube Test poorly. The play and toy idea which the Cube Test arouses may be productive of the keen interest which is often met with in young subjects.

A number of subjects can handle four cubes perfectly but make a complete failure with five cubes. A five-cube movement is never performed accidentally, whereas the four cube occasionally is.

To execute the Five-Cube Test successfully a subject must move in accordance with his first inclination. In this test the examiner should mentally give the subject a certain amount of credit if he shows that he has the correct idea of combinations, even though the performance must be scored a failure, as when the movement 42 135 is substituted for the correct movement 24 135.

In their anxiety to excel in the test some subjects strive to imitate the examiner and hold the spool just as he did. In this case the essential feature of the test is missed and mistakes are made. Other immigrants assume a suggestible attitude; i. e., after touching a cube they look at the examiner to see if they can obtain a sign from him indicative of their good performance. This attitude may also result in failure.

In examining an immigrant with the cubes and other tests the examiner should always put these questions to himself: Is the subject interested in the test? Is he cooperating? Is he emotionally quiet? Is the environment in which this test is performed suitable? Not only is an immigration station different from a school, store, recruiting office, or jail, but the different parts of the station are different one from the other.

COUNTING DOTS.

Between trial 1 and trial 2 of the Geographic Test (see p. 83) the immigrant counted the dots on a card. The card contained 53 dots which were arranged in irregular groups occupying 4 rows. (Fig. 4.)

METHOD OF TESTING.

The dot-counting card was placed on the table in front of the subject and the interpreter, pointing to the dots of the first two rows, said:

Count all the dots on this card; thus 1, 2, 3, 4, 5, and so on.

The number of dots which the immigrant obtained together with the time required for the counting was recorded on his examination chart.

RESULTS.

The results of this test are given below:

TABLE 12.—*Results of Counting Dots Test.*

Group.	Number examined.	Successes.				Failures.								
		Number giving correct result (53 dots).	Percentage of successes.	Average time.	Time ranged between—	Number of dots immigrant obtained and time he required. (Superior numerals indicate the number of immigrants in each group getting the same results, the number of seconds given being an average of the time required by each.)								
						43 dots.	46 dots.	47 dots.	51 dots.	52 dots.	54 dots.	55 dots.	61 dots.	63 dots.
Literate:				*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*	*Secs.*
9–11	12	11	91⅔	34	25–43	.....	.....	.....	.....	35	.....	.....	.....	.....
Hebrew, 9–11	25	21	84	34	25–48	.....	.....	.....	45	34^{2}	48	.....	.....	.....
12–14	37	28	75⅔	34	22–52	.....	.....	25	28	32^{2}	40^{2}	20	35	8
15-above—														
Men	51	41	80	30	18–49	47	37	.....	40	34	36^{2}	.....	.....	.....
Women	48	38	79	33	20–46	.....	.....	.....	37	31^{7}	35	27	.....	.....
Illiterate:														
10–11	2	2	100	44	42–46	.....	.....	.....	.....	.....	.....	.....	.....	.....
12–14	8	6	75	38	28–41	.....	.....	.....	.....	46^{2}	.....	.....	.....	.....
15-above	27	22	81½	34	23–43	.....	.....	.....	.....	43	40^{3}	45	.....	.....
Italian—														
Men	20	18	90	31	21–49	.....	.....	.....	.....	27^{2}	.....	.....	.....	.....
Women	20	[1]17	85	35	22–45	.....	.....	.....	.....	45	52	.....	.....	.....
Slav—														
Men	10	10	100	37	28–55	.....	.....	.....	.....	.....	.....	.....	.....	.....
Women	29	21	72½	48	26–70	.....	.....	.....	.....	58^{2}	45^{4}	$43\frac{1}{2}^{2}$	.....	.....

[1] One immigrant in this group would not count the dots.

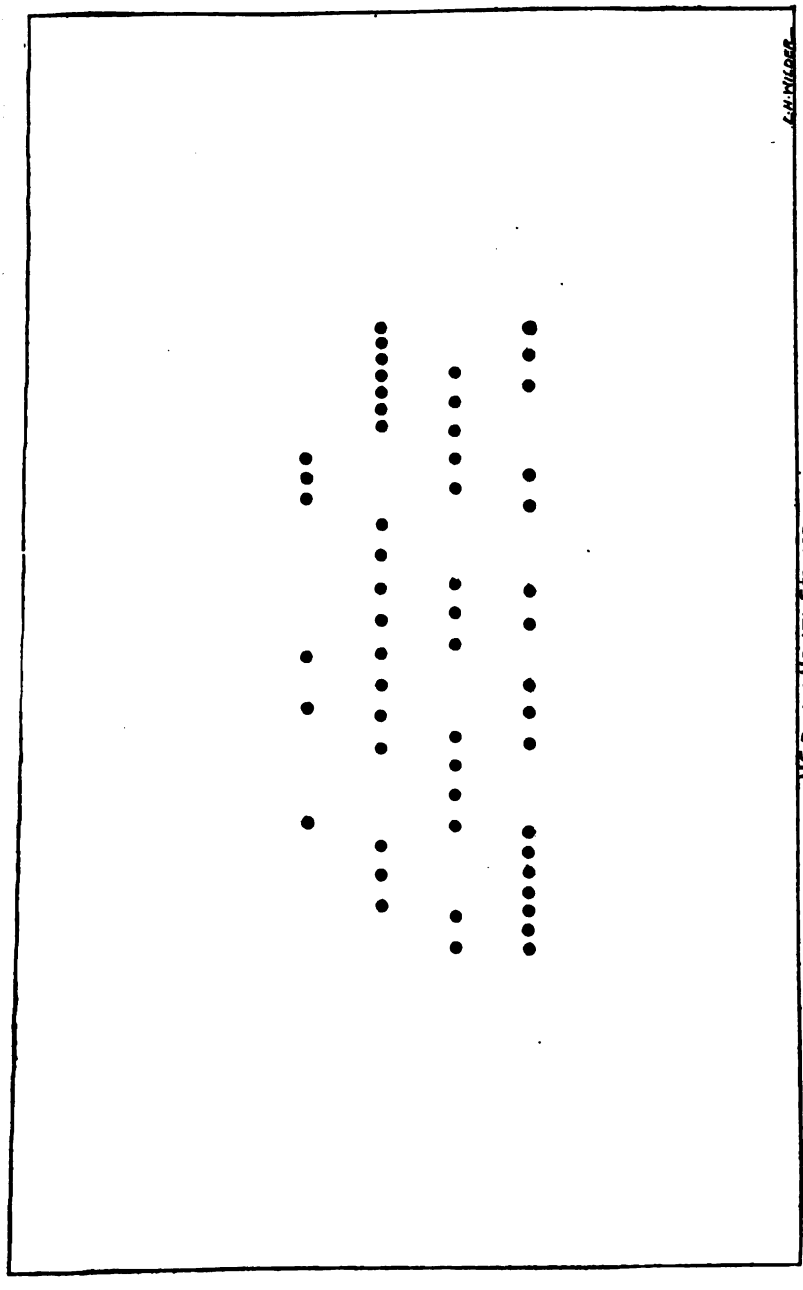


FIG. 4.—Card used in Dot-Counting Test.

SUMMARY OF RESULTS.

Seventy-five per cent of all the immigrants tested succeeded in making an accurate count.

The only subgroup which fell below the 75 per cent mark was that of the women of the *Slav illiterate* group. Seventy-two and one-half per cent of their number made an accurate account.

The accuracy of the count, above the age of 9, appears to be independent of race, age, and formal schooling.

The performance time of the literates is faster than that of the illiterates. The average time in the literate groups varied from 30 to 34 seconds, while in the illiterate groups it varied from 31 to 48 seconds.

DISCUSSION.

This test, in a broad sense, is a memory test. It shows the speed and accuracy with which a subject can apply a fixed number association to the task of dot counting. The subject who is accustomed to counting will count these dots easily, it may be said almost reflexly, but it is a more laborious task for one who has done little counting. A number of immigrants who evidently did little counting at home had much difficulty in counting beyond 29. They would say "twenty ten" instead of "thirty." They had to be assisted over the thirtieth, fortieth, and fiftieth dots. This assistance was given especially in the case of the women of the *Slav illiterate* group. Several immigrants who counted 53 dots made two mistakes while counting, inserting an extra dot in one instance and skipping one in another, one mistake counteracting the other.

LEARNING.

Learning is a complex test similar to a recognition test suggested for the experiment by Prof. Henry Alford Ruger, and is applied according to the learning principle in testing.

It consisted in exposing 3 geometrical figures on the back of a card to the subject's view and getting him to find the same 3 figures among 20 figures on the face of the card. (Figs. 5 and 6.) He was scored on the number of exposures or trials that were necessary to accomplish the task.

METHOD OF TESTING.

The face of the card containing 20 different geometrical figures was placed in front of the immigrant for a brief glance (2 or 3 seconds).

The card was then turned over, so that he could observe the side containing the 3 geometrical figures. At the same time the interpreter said:

Look at these 3 figures well; fix them in your mind. I want you to find them on the other side of the card.

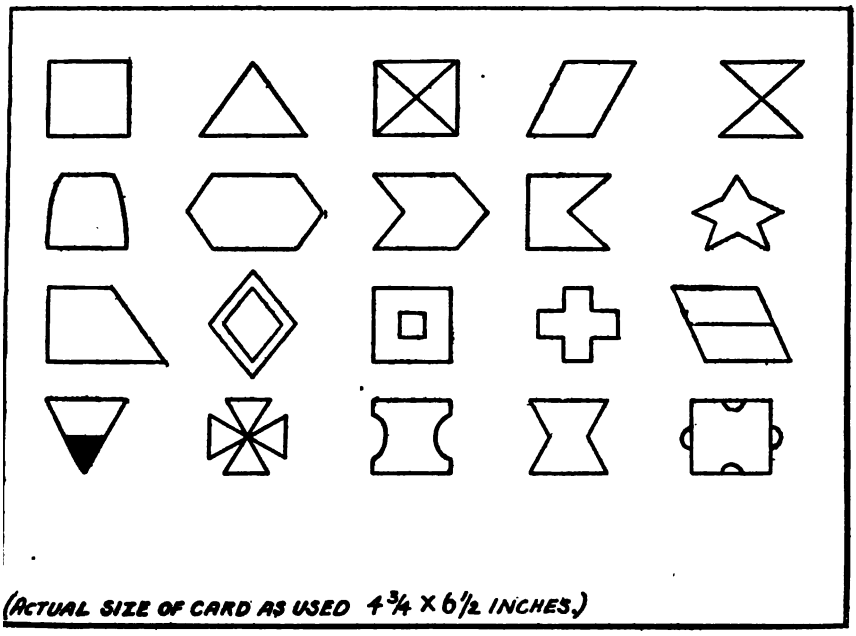


FIG. 5.—Face of card used in Learning Test.

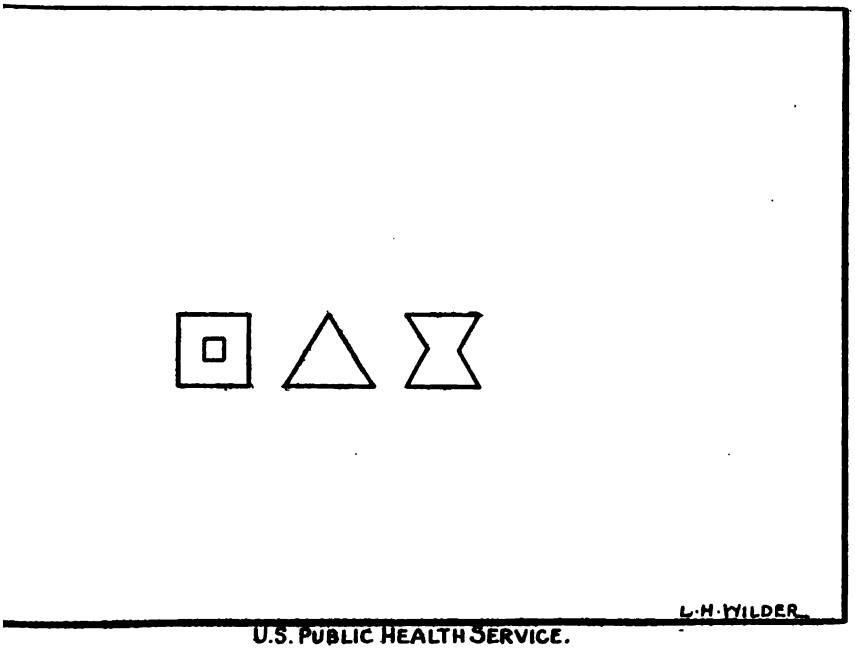


FIG. 6.—Back of card used in Learning Test.

After 10 to 15 seconds the card was turned over, so that the 20 geometrical figures came into view. The interpreter then said:

Look well; find the 3 figures among them.

As soon as the subject made a mistake, the card was immediately turned over, so as to obtain another view of the 3 geometrical figures. This second and each subsequent exposure to the 3 figures lasted only 5 or 6 seconds. The card was again turned over, and the subject searched for the 3 figures among the 20 figures for a second time.

As before, as soon as a wrong figure was pointed to the card was quickly reversed in order to obtain a third exposure of the 3 figures. This process of exposing the 3 figures, turning over the card, and having the subject search for them was repeated until he succeeded in finding all 3 at the same trial. The immigrant was scored on the number of exposures of the 3 figures which were necessary in order to accomplish the task.

RESULTS.

The results of this test are given in the following table:

TABLE 13.—*Results of Learning Test.*

Group.	Number examined.	Number succeeding in 4 or less trials.				Percentages.		Number succeeding in more than 4 trials.						
		1 trial.	2 trials.	3 trials.	4 trials.	Number succeeding in 3 or less trials.	Number succeeding in 4 or less trials.	5 trials.	6 trials.	7 trials.	8 trials.	10 trials.	12 trials.	15 trials.
Literate:														
9–11	12	5	6	1	.....	100	100	....	....	....	....	....	....	....
Hebrew 9–11	25	8	10	4	2	88	96	....	1	....	....	....	....	....
12–14—														
Boys	18	6	6	3	2	83½	94½	....	....	....	1	....	....	....
Girls	19	4	7	6	1	89½	94½	....	1	....	....	....	....	....
15-above—														
Men	50	11	21	13	4	90	98	....	1	....	....	....	....	....
Women	49	16	16	11	2	87½	91½	2	....	1	1	....	....	....
Illiterate:														
10–11	4	1	.....	1	1	50	75	1	....	....	....	....	....	....
12–14	8	.....	4	1	1	62½	75	1	....	1	....	....	....	....
15-above—														
Men	20	4	7	5	1	80	85	1	1	....	1	....	....	....
Women	8	.....	1	5	.....	75	75	2	....	....	....	....	....	....
Italian—														
Men	20	2	6	3	5	55	80	1	....	2	1	....	....	....
Women	20	2	5	3	3	50	65	....	....	....	3	1	1	2
Slav—														
Men	10	3	3	2	1	70	80	1	....	....	....	1	....	....
Women	30	11	10	5	1	86⅔	90	3	....	....	....	....	....	....

CONCLUSIONS.

The important conclusions to be drawn from the data above presented are that:

Seventy-five per cent of all the immigrants tested were able to succeed in the Learning Test with four trials or less. However, only 65 per cent of the women of the *Italian illiterate* group succeeded in performing the test with four trials or less.

The literate groups greatly excelled the illiterates in the performance of this test. Over 83 per cent of each literate group succeeded in doing the test within three trials. Among the illiterates the women of the *Slav illiterate* group made an excellent record.

In the literate groups the young immigrants do the test as well as the older ones. Among illiterates the young immigrants do the test nearly as well.

DISCUSSION.

Auditory memory is especially involved in many of the memory tests of this investigation. The present test differs from others in that it tests the visual-apprehending-retaining apparatus of the subject.

In apprehending the three geometrical forms, the subject must analyze them and differentiate them. They must be retained sufficiently long to be recognized. The ease with which the immigrant retained and recognized these forms was to some extent an index of his learning ability.

As in many other tests, previous experience has much to do with the quick performance of this test. This is proven by the excellent showing which the literates make. They have on previous occasions, in a more or less systematic way, familiarized themselves with these and similar forms. While they may be unaware of the fact, nevertheless they have made such observations at school, at work, and at play. Even the illiterates have observed and retained forms of different kinds, especially those whose occupations have made them familiar with geometrical designs. If forms of various kinds are poorly perceived or if not perceived at all, it is more than likely that there is some defect in the apprehension and perception function of the individual. The examiner had the opportunity of trying this test on several immigrants who had been certified as feeble-minded. These certified immigrants accomplished the test in 6, 8, 10, 12, and more trials.

The examiner believes that the Learning Test is one of the best for use in the mental examination of arriving immigrants. Should this test be used when examinations are repeated, cards containing 20 other simple geometrical designs or the same designs in different arrangement should be used.

OBEYING COMMANDS.

This test consisted in finding how many commissions a subject could execute in definite order after being given definite instructions.

METHOD OF TESTING.

Four series of commands were given to each subject, as follows:

Two commands.—1. Open door. 2. Chair near window.

Three commands.—1. Book on floor. 2. Chair in corner. 3. Pencil on chair.

Four commands.—1. Pencil on table. 2. Close door. 3. Book on table. 4. Block on floor.

Five commands.—1. Block on table. 2. Book on floor. 3. Open door. 4. Chair near window. 5. Pencil in corner.

In every case the interpreter would start with the two-command series. Whether a success or a failure occurred, the alien would be tested with the next higher series. Before giving the command, the interpreter would point to the different details in the room connected with the test, saying, "There is the book, pencil, block, table, floor, door, corner, chair, window." The interpreter would then give each series of commands twice. In the case of the two-command series he would say, "First open the door (pointing to it); then place the chair near the window (pointing to it)." The alien usually executed this series promptly, though sometimes he had to be urged to carry out the command. After executing the commands he would return and take his seat at the end of the table. The objects were arranged in accordance with the demands of the next series before the test was continued.

In the final score, the immigrant was allowed one-half point if he executed the commands of a higher series but failed to carry them out in order.

RESULTS.

A table of results is given to show how many immigrants succeeded in obeying at least four commands:

TABLE 14.—*Results of Obeying Commands Test.*

Group.	Number examined.	Execution of four commands or more.				Execution of less than four commands.				
		Number of aliens.			Per centage.	Number of aliens.				Per centage.
		Five commands.	Four commands.			Three commands.		Two commands.		
		5	[1] 4½	4		[1] 3½	3	[1] 2½	2	
Literate:										
9–11	12	8	1	3	100					
Hebrew, 9–11	25	12	6	3	84	3		1		16
12–14:										
Boys	18	8	5	3	89—		1	1		11+
Girls	19	13	1	1	79—	4				21+
15-above—										
Men	51	31	8	3	82+	6		2	1	18—
Women	49	26	12	8	93½+	2		1		6 +
Illiterate:										
10–11	4	4			100					
12–14	8	4	1	1	75			1	1	25
15-above—										
Men	21	12		5	81—		4			19+
Women	8	4	2	1	87½				1	12½
Italian—										
Men	20	7	4	5	80	1	1		2	20
Women	20	8	3	1	60	3	1	3	1	40
Slav—										
Men	10	5	3	2	100					
Women	30	15	7	3	83½	3	1		1	16½

[1] One-half shows that the immigrant, in addition to executing correctly the commands indicated in the table, also carried out the commands of the next higher series, but in an improper order.

With the exception of the women of the *Italian illiterate* group, 75 per cent of every group succeeded in obeying at least 4 commands. Those who succeeded in obeying 5 commands were greater in number than those who could only complete the 4 or 3 commands. The *illiterate 10–11* group, from which we would naturally expect the poorest result on account of youth and illiteracy, made a perfect score, each individual scoring 5.

CONCLUSIONS.

From the data above presented it is safe to conclude that:

(1) Arriving immigrants above the age of 9, whether literate or illiterate, are able to obey 4 commands.

(2) If the examination is conducted as described in this experiment it may be expected that 50 per cent of the subjects will make a perfect score in this test.

(3) On the whole there is no marked difference in the performance of this test as regards sex.

DISCUSSION.

A number of subjects succeeded in carrying out 5 commands after having failed in the 3-command or 4-command series. Failure in the earlier series in these particular cases was probably due to a lack of understanding as to just what was wanted, or to lack of familiarity with some of the objects used in this test or perhaps to temporary inattention due to some accidental cause.

In carrying out this test it is important to remember that emphasis should be laid upon the first and last command of each series. This method of applying the test implies that the separate commands must be carried out in a definite order and thus does away with the necessity of "too much explaining."

Several immigrants made one or two mistakes in executing a series. However, they quickly saw their mistake, made the correction, then went through the series from first to last as it should be done. It is needless to say that such a performance was considered a success.

An individual's early training is largely concerned in obeying commands. Therefore, the movements required in obeying the different commands in this test are a familiar procedure. For similar reasons disturbed subjects frequently become more quiet while performing this test.

It is interesting to note that several immigrants were able to obey 5 commands but could not possibly repeat 5 digits.

ARRANGING OBJECTS.

In the Arranging Objects Test the subject was tested in his ability to select certain objects from a field containing 16 heterogeneous pieces and place them on a board in a certain order after having seen

the same operation carried out by the examiner. The board, a part of the Cube Test (see p. 39), contained 5 shallow square openings. It was placed on the examining table parallel with and about 9 inches from the table edge. The field was that portion of the table which was bounded by the edge and board. It was about 20 inches long and 9 inches broad and contained the 16 heterogeneous pieces, each placed in a definite marked position with which the experimenter was familiar. The pieces were odds and ends picked up in a child's playroom. Between some of them there were certain resemblances. For instance, piece 2 was a red block, while piece 12 was a white block of the same size; piece 3 was a wooden pig, while piece 6 was a wooden chicken of the same color; and piece 1 was a large coin, while piece 14 was a small coin. The pieces were arranged in the field as shown in the accompanying illustration (fig. 7).

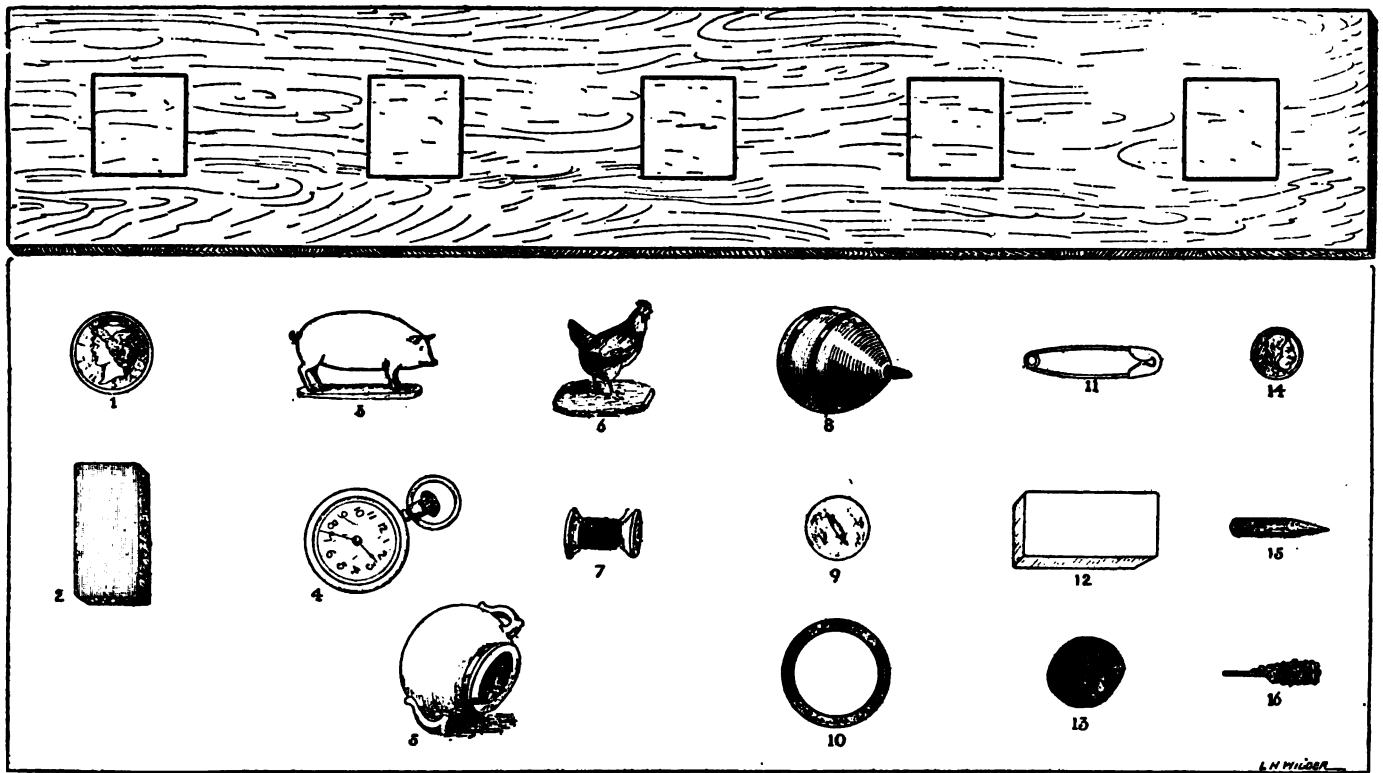
METHOD OF TESTING.

The subject stood at the edge of the table and faced the board and field. The experimenter, with stop watch in hand, stood at the subject's left. The experimenter said to the subject, "Look well," and at the same time picked up the penny and placed it in the first square opening of the board. He placed the pig in opening 2 of the board and then placed the chicken in opening 3. The board containing the three pieces (penny, pig, chicken) was exposed to the immigrant's view for 10 additional seconds. Then the examiner turned the immigrant completely about, so that the latter could not see the board.

When the immigrant was thus turned about, the examiner returned the 3 pieces to their respective positions in the field. The subject was then turned to again face the board and was instructed to place the same 3 pieces in the 3 openings of the board just as the examiner had done. The immigrant was always [1] able to do this without difficulty.

The examiner went through the same process again, but this time placed 4 different pieces on the board. They were arranged from left to right as follows: *Chain, nut, red block, pin.* When the immigrant failed to make the proper arrangement he was given a second trial with 4 other pieces. After the subject had succeeded with 4 pieces he was tested with 5 pieces. The examiner continued the process, each time increasing the number of pieces until the subject failed in two trials to make a given arrangement. He was then given a score equivalent in points to the number of objects successfully arranged. If, in spite of failure in a second trial, he selected the proper pieces but in a wrong order, or kept to the right order though selecting 1 wrong piece, one-half point was added to his score.

[1] One woman of the Italian illiterate group failed to arrange 3 objects.



U.S. PUBLIC HEALTH SERVICE.

FIG. 7.—Board and field, with 16 pieces, used in Arranging Objects Tests. 1. Large coin. 2. Red block. 3. Pig. 4. Watch. 5. Dish. 6. Chicken. 7. Spool. 8. Tin top. 9. Button. 10. Ring. 11. Pin. 12. White block. 13. Horse chestnut. 14. Small coin. 15. Pencil. 16. Chain.

The following pieces and arrangements of them represent the different tests that were used at the first trial:

Four-piece.—Chain, nut, red block, pin.
Five-piece.—Spool, dish, watch, ring, nut.
Six-piece.—Button, white block, chicken, pencil, top, dish.
Seven-piece.—Ring, dish, penny, pin, chain, watch, chicken.
Eight-piece.—Spool, button, white block, red block, pin, top, ring, nut.
Nine-piece.—Dish, large coin, chain, penny, button, spool, top, white block, nut.

Except in the case of the Five-Piece Test [1] the same objects, but in reverse order, were used in conducting the second trial.

RESULTS.

The results of these tests are given below:

TABLE 15.—*Results of Arranging Objects Test.*

Group.	Number examined.	Number of aliens arranging different numbers of objects.[1] (One-half point is scored where immigrant uses correct objects in wrong order or 1 incorrect object in right order.)												How the one-half point was scored.	
		9 objects.	8 objects.		7 objects.		6 objects.		5 objects.		4 objects.		3 objects.		
		0 points.	8½ points.	8 points.	7½ points.	7 points.	6½ points.	6 points.	5½ points.	5 points.	4½ points.	4 points.	3½ points.	3 points.	Correct objects in incorrect order.	Correct order; 1 incorrect object.
Literate:																
9-11	12						2	2	3	3	2				3	4
Hebrew 9-11	24						1	3	3	9	8				6	6
12-14—																
Boys	18					1	1	4	3	6	2	1			3	3
Girls	13	1				1	1	2	4	4	4	1	1		7	3
15-above—																
Men	51		1		2		3	4	12	11	10	3	3	2	23	9
Women	48			1	2	1	1	6	17	8	8	1	3		21	10
Illiterate:																
10-11	4							1	1	2						1
12-14	8								1	2	3		1	1	3	2
15-above	[2] 28						3	7	5	6	1	6			12	7
Italian:																
Men	20					1		2	1	3	4	4	3	2	7	1
Women	[3] 20							2	1	3	6		4	3	8	3
Slav—																
Men	10						1	2	3	4					5	1
Women	29					2	2	2	7	6	5	4	1		9	6

[1] A alien recorded as arranging a given number of objects has also arranged the series containing fewer objects.
[2] 29 examined; 28 recorded.
[3] 1 woman in this group failed to arrange 3 objects.

It will be observed that 40 children under the age of 12 were examined and not one of them scored under 4½ points.

The fact of literacy does not seem to have influenced the execution of this test.

DISCUSSION.

This test is somewhat different from the other memory tests. In addition to retaining and recalling, action on the part of the subject

[1] Pieces used for trial 2 were pig, ring, pencil, red block, top.

is required. It has been found in testing immigrants that, where action is injected into a memory test, the subject makes a better showing than in a test wherein simple verbal recall takes place. This better showing in action-memory tests is more noticeable in the case of "Obeying Commands" than in the present test.

On account of the similarity existing between some of the pieces, undoubtedly in certain instances the acts of comparing and discriminating accompanied the act of recalling.

Occasionally, after the performance of the test, the immigrant was asked as to how he performed it. The answers showed that both auditory and visual methods were employed. When the immigrant performed the test with the assistance of word memories, it was noticed that he performed it by arranging the pieces one after another in regular order either from right to left or from left to right.

In a number of instances the subject would correctly arrange the pieces but would take them up in an irregular order. In these cases the subject almost invariably stated that he held a mental picture of the arranged objects and did not think of their names while replacing them on the board. No attempt was made by the examiner to find how many had succeeded by either the auditory or visual method.

The best record was made by a Norwegian girl, age 14, who scored 9 points. When questioned as to how she succeeded, she said that she did not look at the board but at the field, retaining the exact order in which the examiner removed the pieces from the field. It is possible that she had performed a similar test before.

The successful performance of this test implies that retention takes place over a comparatively long period, which becomes progressively longer as the test proceeds. In other words, the larger the number of objects retained the longer the retention, because it required a longer time for the examiner to return the pieces from the board to the field.

Perseveration was shown by a number of immigrants. For instance, in attempting to do the Six-Piece Test, the alien would carry out the Five-Piece arrangement which had been executed one or two minutes before.

In arranging the different tests a number of immigrants, probably audiles, proceeded in regular order from right to left. This manner of performance is evidently due to ignorance, the immigrant not being sufficiently familiar with right and left order. In many cases this test brought about a strained condition of the attention and fatigue. At times, however, the test seemed to quiet a tremulous, anxious, and otherwise disturbed subject. In some instances standing up while undergoing the test and doing certain things seemed to be productive of a more quiet emotional state and a healthier attitude during the remainder of the examination.

After understanding what is wanted, the average subject assists in the execution of this test. He will turn about, return to the table, and execute the arrangement at the proper time.

An advantage of this test is that it can be executed without the assistance of an interpreter.

NUMBER OF MONTHS IN THE YEAR.

The following table shows how the different groups responded to the question, "How many months are there in a year?"

TABLE 16.—*Results of Number of Months in the Year Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number giving correct answers.	Percentage giving correct answers.	Group.	Number examined.	Number giving correct answers.	Percentage giving correct answers.	Group.	Number examined.	Number giving correct answers.	Percentage giving correct answers.
9–11	12	12	100	10–11	4	4	100	Italian: Women	20	18	90
Hebrew, 9–11	25	24	96	12–14	8	8	100	Slav:			
12–14	37	34	92	15-above	27	26	96	Men	10	9	90
15-above	99	98	99	Italian: Men	20	20	100	Women	30	26	87

NAMES OF MONTHS.

In response to the command "Name the months in the year," the results shown in the following table were obtained. It may be concluded from these results that many normal or average immigrants are unable to perform this test. The men of the *Italian illiterate* group excelled all other illiterate groups.

TABLE 17.—*Results of Names of Months Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number succeeding.	Percentage succeeding.	Group.	Number examined.	Number succeeding.	Percentage succeeding.	Group.	Number examined.	Number succeeding.	Percentage
9–11	12	7	58½	10–11	4	0	0	Italian: Women	20	11	55
Hebrew 9–11	25	14	56	12–14	8	2	25	Slav:			
12–14	37	27	73	15-above	27	15	55½	Men	8	4	50
15-above	99	85	85½+	Italian: Men	20	16	80	Women	27	5	18

NUMBER OF DAYS IN THE YEAR.

The question "How many days are there in a year?" was asked each immigrant. On the whole, the replies were very unsatisfactory. The following table shows the number of immigrants who succeeded in giving correct and approximately correct answers (360 to 366 and the number who responded by saying "I don't know," or wh

did not approximate the correct reply. It is evident from these tables that illiterate immigrants and young literates can not be expected to give the correct response to this question.

TABLE 18.—*Results of Days in the Year Test.*

Group.	Number examined.	Number giving correct or approximately correct replies.							Number saying "I don't know."	Other replies given. (Superior numeral indicates that two aliens in same group gave same reply.)
		Number who said 365.	Number who said 366.	Number who said 365 and 366.	Number who said 364.	Number who said 363.	Number who said 362.	Number who said 360.		
Literate:										
9–11	12	....	1	....	....	....	....	1	5	356, 355, 350, 150, 135.
Hebrew 9–11	25	1	....	....	....	....	....	2	17	370, 350, 173, 160, 52.
12–14	37	7	2	....	1	....	....	2	13	350², 380, 345, 153, 150, 136, 100, 900, 1,000², 1,063.
15-above—										
Men	51	19	9	4	....	1	1	4	6	375, 300², 376, 165, 126, 65.
Women	49	23	2	1	....	1	....	3	7	375, 352, 350, 344, 316, 300, 500², 600, 656, 102, 1,323.
Illiterate:										
10–11	4	....	....	....	....	....	....	....	3	52.
12–14	8	....	....	....	....	1	....	....	7	
15-above	27	7	....	2	....	1	....	....	11	375, 330, 164, 100, 466, 370 and 371.
Italian—										
Men	[1]20	6	9	....	....	....	....	....	3	310.
Women	20	1	4	....	....	....	....	....	10	300, 500, 100, 30².
Slav—										
Men	9	1	1	2	....	1	....	....	1	300, 370, 263.
Women	30	5	....	1	....	....	....	....	20	385, 350, 300².

[1] One of this subgroup answered 363 or 366.

DATE.

Each immigrant was questioned as to the month, day of month, nd day of week. The results were as follows:

TABLE 19.—*Results of the Date Tests.*

est.	Literates.				Illiterates.							
	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
nth	9–11	12	7	58⅓	10–11	4	0	0	Italian: Women	20	16	80
	Hebrew 9–11	25	85	32	12–14	8	4	50	Slav:			
	12–14	37	24	64⅓+	15-above	27	17	63 −	Men	10	4	40
	15-above	99	88	88⅓+	Italian: Men	20	17	85	Women	30	11	36⅔
of nth	9–11	12	3	25	10–11	4	0	0	Italian: Women	20	9	45
	Hebrew 9–11	25	1	4	12–14	8	3	37½	Slav:			
	12–14	37	14	37⅓+	15-above	27	12	44⅓+	Men	10	2	10
	15-above	99	66	66⅔	Italian: Men	20	12	60	Women	30	3	10
of eek	9–11	12	9	75	10–11	4	3	75	Italian: Women	20	15	75
	Hebrew 9–11	25	23	92	12–14	8	5	62½	Slav:			
	12–14	37	32	86⅓	15-above	27	18	66⅔	Men	10	9	90
	15-above	99	89	89⅓+	Italian: Men	20	16	80	Women	30	29	96⅔

The above table shows that in responding as to what month it was, 75 per cent of the *literate 15 and above* and *Italian illiterate* groups succeeded, while the other groups made a poor showing.

In responding to the question as to what day of the month it was the *literate 15 and above* group made the best showing, 66⅔ per cent of their number giving the correct day of the month.

In responding to the question as to what day in the week it was, 75 per cent of all the immigrants examined gave the correct reply. However, the *illiterate 12–14* and *illiterate 15 and above* groups fell below the 75 per cent mark.

From these results it may be concluded:

That many normal immigrants above the age of 9, when questioned in regard to the date, are unable to give the correct month or day of the month, but are able to give the correct day of the week.

NUMBER OF DAYS IN WEEK.

The question "How many days are there in a week?" was asked of each immigrant. Most frequently a correct response was given, but 8 and 6 were also frequent answers. The following table shows the exact replies.

TABLE 20.—*Results of Number of Days in Week Test.*

Group.	Number examined.	Number giving correct reply.	Number saying "I don't know."	Number giving other replies.			
				Number who said 5.	Number who said 6.	Number who said 8.	Number who said 14.
Literate:							
9–11	12	8			3		
Hebrew 9–11	25	22				3	
12–14	37	34			3		
15–above	99	67			24	8	
Illiterate:							
10–11	4	3	1				
12–14	8	3	1		3	1	
15–above	27	14	1		11	1	
Italian—							
Men	20	11	1		7	1	
Women	20	13		1	6		
Slav—							
Men	10	8			1	1	
Women	30	14			16		

NAMES OF DAYS IN WEEK.

Each immigrant was requested to name the days in the week. Seventy-five per cent of every group succeeded. The literates excelled the illiterates. The following table gives the results.

TABLE 21.—*Results of Naming the Week Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	12	12	100	10–11	4	3	75	Italian: Women	20	19	95
Hebrew 9–11	25	21	96	12–14	8	7	87½	Slav:			
12–14	37	37	100	15-above	27	26	96⅓	Men	10	10	100
15-above	100	100	100	Italian: Men	20	17	85	Women	30	30	100

NAME OF SHIP.

Each immigrant was asked the name of the ship upon which he had come.

Table 22 shows that the literates excel the illiterates in this test. Many illiterates fail to answer the question. It is interesting to note how well the Italians, both men and women, responded to this question. It is possible that the frequent going and coming of this race and the interest in emigration manifested by the Italian Government may have something to do with the satisfactory replies which the Italians make to this question.

TABLE 22.—*Results of Name of Ship Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
11	12	11	91⅔	10–11	4	2	50	Italian: Women	19	17	89½
ebrew, 9–11	24	22	91⅔	12–14	8	5	62½	Slav:			
-14	37	34	91⅞	15-above	27	23	85+	Men	10	6	60
-above	98	85	86½+	Italian: Men	20	20	100	Women	30	17	56⅔

COPYING AND DRAWING FROM MEMORY.

In this experiment the immigrant copied 5 geometrical figures nd drew 3 such figures from memory. (See fig. 8.)

METHOD OF TESTING.

Drawings on cards of 5 geometrical figures—a square, diamond, uble trapezoid, bent-wire figure, and allied-Ziehen figure—were ced one at a time in front of the immigrant, who copied them on finite parts of paper ruled for the purpose.

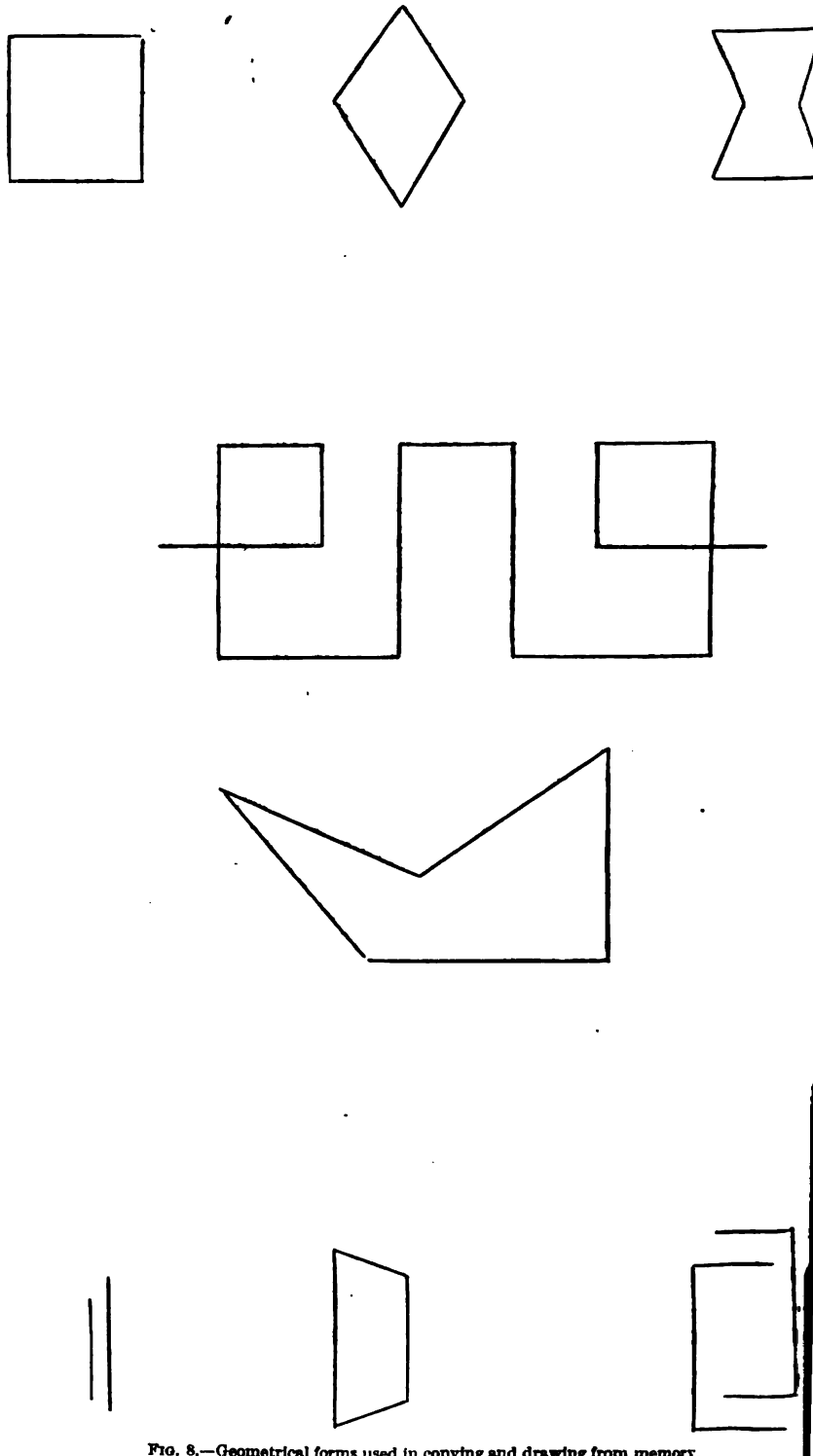


FIG. 8.—Geometrical forms used in copying and drawing from memory.

The first memory drawing was of two parallel lines and was used simply to introduce the test. The other geometrical figures used were a trapezoid and an interlocking figure, the former being exposed for 5 seconds, the latter for 10. Immediately after each exposure the immigrant made his drawing from memory.

Frequently, in the case of illiterates, the question was asked, "Have you ever had a pencil in your hand before?" Many responded in the negative.

The drawings were made in pencil, and at the termination of the examination they were traced in ink for preservation and reproduction.

CLASSIFICATION OF IMMIGRANTS' DRAWINGS.

Each immigrant's drawing, with the exception of the square and parallel lines, was placed in one of three grades by the mutual agreement of the interpreter and the examiner. If they disagreed as to how a drawing should be classified, a third person was called in to consider the drawing carefully and make the final decision as to classification. The poorest drawings were placed in grade 1, while the best ones were placed in grade 3. For the purpose of classification two standard drawings were made of each geometrical figure and arranged one above the other. (See fig. 9.) The upper standard in each instance was a better drawing and approached the original geometrical figure more closely in appearance than the lower one.

To be entitled to grade 3, an immigrant's drawing would have to be at least as good as the upper standard. To be classed in grade 2, the drawing would have to be equal to or better than the lower standard. If a drawing was not as good as the lower standard, it was placed in grade 1.

In placing a drawing in one of the three grades the examiner and interpreter in each case considered the following points:

(1) How did the drawing which was to be classified resemble the original in general appearance?

(2) Could a person who had not seen the original drawing tell from what design the drawing in question was copied or memorized?

(3) The drawing to be graded was considered and compared with the two standards; that is, comparisons were made between the drawing and standards as regards the straightness of lines and trueness of angles. The proportion of one element of the drawing to another element was compared with the proportions of the standards. The completion of lines and the introduction of extra lines into the drawing were considered. The good features of the drawing were permitted to counterbalance the bad ones of the standards, and vice versa.

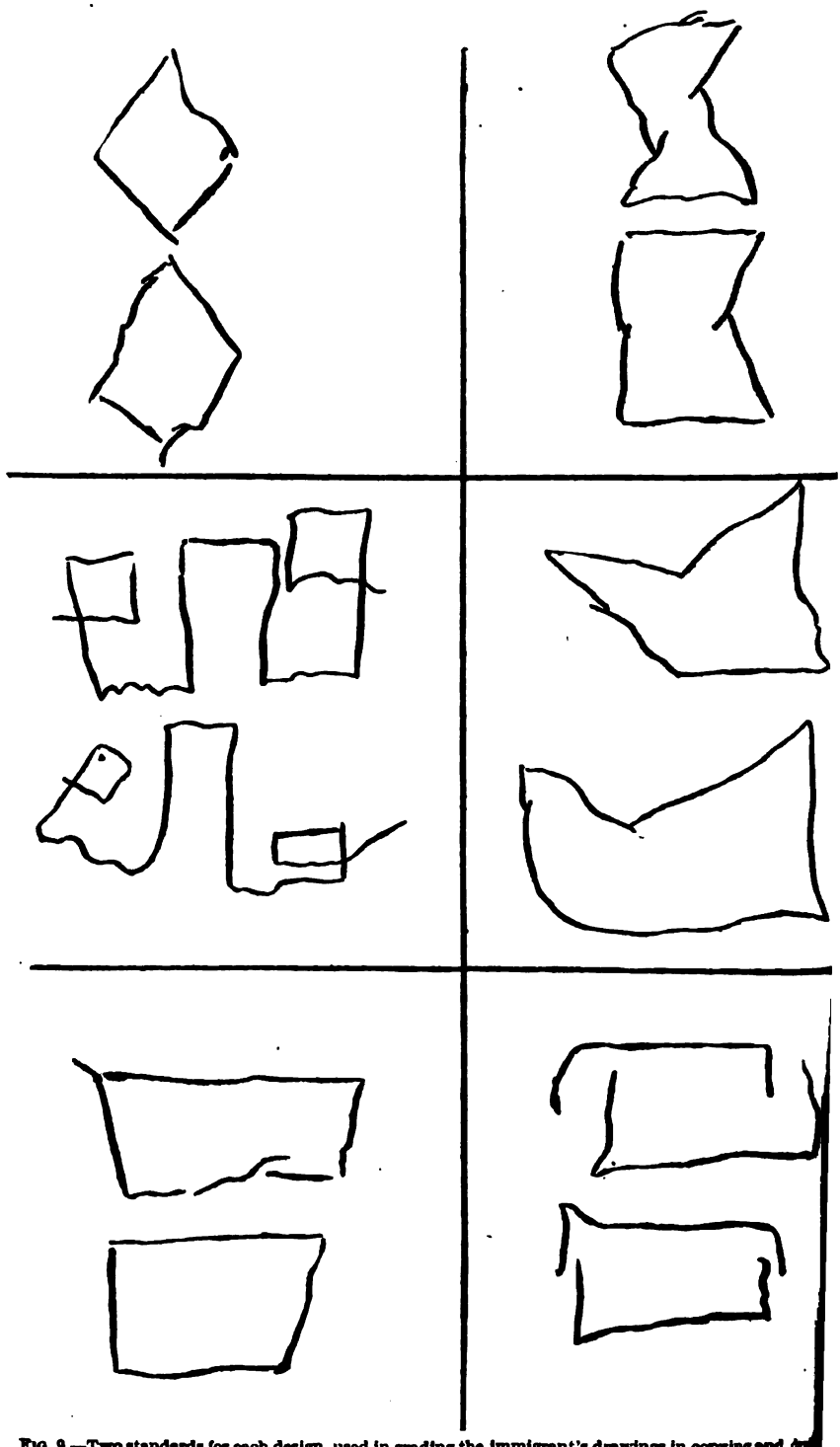


FIG. 9.—Two standards for each design, used in grading the immigrant's drawings in copying and de memory.

(4) Where certain elements of a drawing suggested that it be placed in grade 1 and other elements suggested that it be placed in grade 3, it was placed in grade 2.

(5) In order for the examiner to place in grade 3 a memory drawing of the interlocking figure, the general outline of the figure and proper overlapping would have to be carried out. To be placed in grade 2, the drawing would need a correct outline and some overlapping, even if the overlapping was incorrect.

SPECIMEN DRAWINGS.

Thirty drawings are reproduced herewith (figs. 10–39). They include the drawings of the 10 men and the first 10 women of the *Slav illiterate* group, the 4 children of the *illiterate 10–11* group, and the first 6 children of the *literate 9–11* group. The figures are photographed from the originals on which the pencil lines had been inked in.[1]

RESULTS.

The results of these tests are given in the following tables:

TABLE 23.—*Results of Copying Tests.*

Group.	Number examined.	Number of aliens making the different grades.												Averages.								
		Diamond.			Double trapezoid.			Bent-wire figure.			Allied-Ziehen figure.											
		Grade 3.	Grade 2.	Grade 1.	Grade 3.	Grade 2.	Grade 1.	Grade 3.	Grade 2.	Grade 1.	Grade 3.	Grade 2.	Grade 1.	3	2.75	2.50	2.25	2	1.75	1.50	1.25	1
Literates:																						
9–11	12	9	1	2	12	...	...	12	...	...	11	...	1	9	1	1	...	...	...	...	...	...
Hebrew 9–11	25	21	2	2	22	1	2	24	...	1	20	3	2	16	4	3	1	...	...	...	1	...
12–14	37	33	3	1	33	4	...	35	1	1	31	2	4	25	6	5	...	...	...	1	...	...
15-above	100	86	6	8	84	4	12	93	5	2	74	12	14	68	9	7	5	2	5	2	...	2
Illiterates:																						
10–11	4	....	2	2	3	...	1	3	...	1	1	1	2	...	...	1	1	1	...	1	...	...
12–14	8	5	...	3	5	...	3	3	2	3	3	1	4	2	...	1	1	1	...	1	2	...
15-above	29	18	2	9	16	6	7	22	1	6	15	3	11	13	1	1	3	3	1	3	1	3
Italian—																						
Men	20	11	2	7	16	1	3	14	1	5	10	3	7	10	1	1	1	1	...	3	1	2
Women	20	5	4	11	7	...	13	8	1	11	4	3	13	2	3	1	...	1	2	...	3	3
Slav—																						
Men	10	8	1	1	7	2	1	10	...	...	7	1	2	5	1	3	...	...	1	...	...	...
Women	30	17	1	12	20	4	6	19	1	10	15	3	12	11	3	3	2	1	...	3	4	3

[1] It is to be noted, however, that for the sake of compactness the designs are placed closer together than the original drawings.

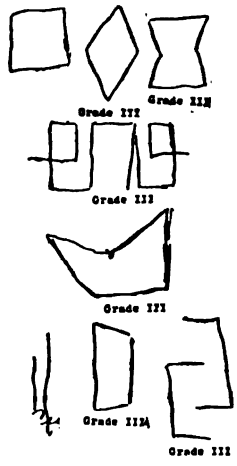


Fig. 10. Copying and drawing from memory by Russian (No. 13 in group), male, 16 years of age, 3½ months' schooling.

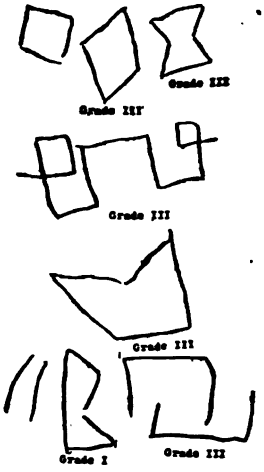


Fig. 11. Copying and drawing from memory by Russian (No. 23 in group), male, 16 years of age, no schooling.

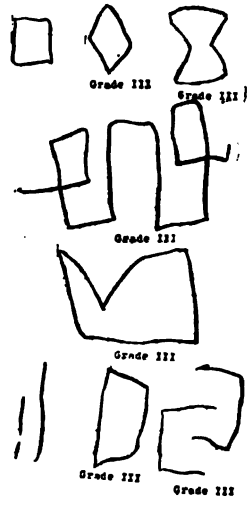


Fig. 12. Copying and drawing from memory by Austrian Ruthenian (No. 25 in group), male, 16 years of age, no schooling. (Never used pencil before.)

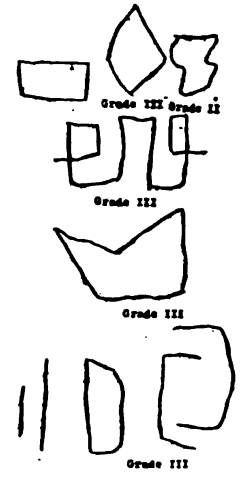


Fig. 13. Copying and drawing from memory by Russian (No. 1 in group), male, 18 years of age, 3 months' schooling.

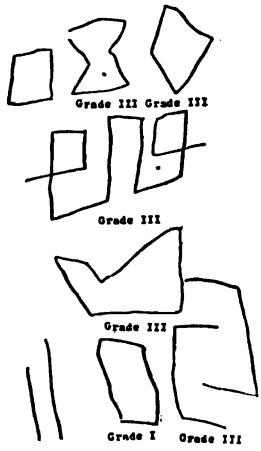


Fig. 14. Copying and drawing from memory by Russian (No. 7 in group), male, 18 years of age, 5 months' schooling.

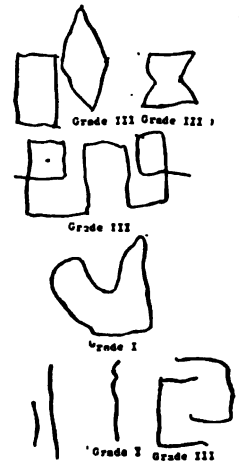


Fig. 15. Copying and drawing from memory by Russian Pole (No. 5 in group), male, 20 years of age, no schooling. (Never used pencil before.)

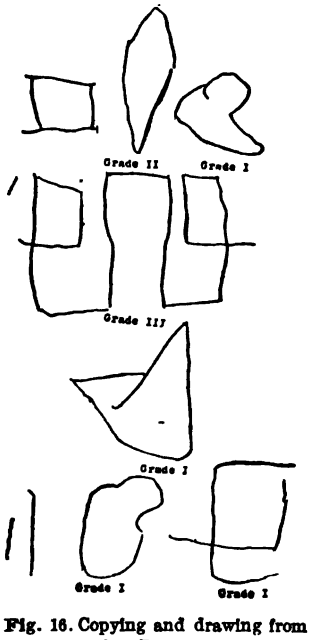


Fig. 16. Copying and drawing from memory by Russian Ruthenian (No. 9 in group), male, 22 years o age, no schooling. (Never used pencil before.)

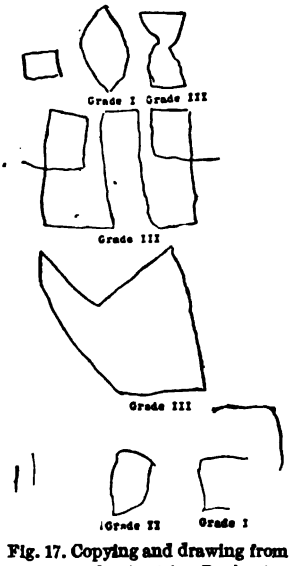


Fig. 17. Copying and drawing from memory by Austrian Ruthenian (No. 11 in group), male, 24 years of age, no schooling.

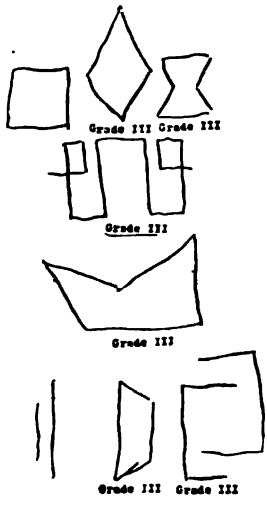


Fig. 18. Copying and drawing from memory by Pole (No. 7 in group), male, 28 years of age, 5 months' schooling.

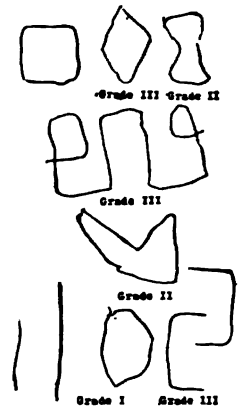


Fig. 19. Copying and drawing from memory by Russian (No. 9 in group), male, 33 years of age, no schooling.

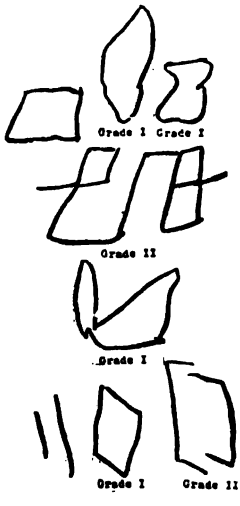


Fig. 20. Copying and drawing from memory by Russian (No. 26 in group), female, 12 years of age, 3 months' schooling.

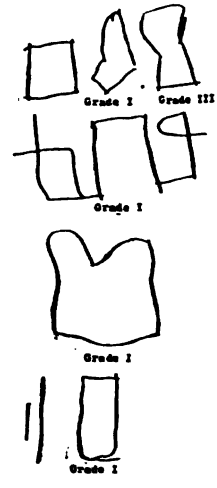


Fig. 21. Copying and drawing from memory by Austrian Ruthenian (No. 22 in group), female, 14 years of age, no schooling. (Alien said, "I never saw a pencil before.")

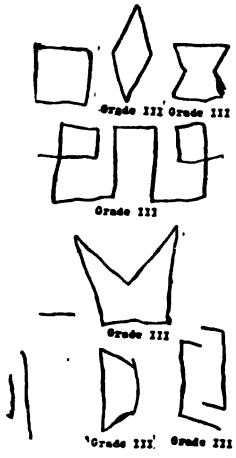


Fig. 22. Copying and drawing from memory by Austrian Ruthenian (No. 7 in group), female, 16 years of age, 4 months' schooling.

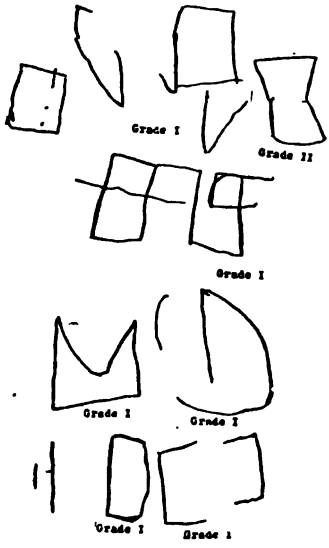


Fig. 23. Copying and drawing from memory by Austrian Ruthenian (No. 14 in group), female, 16 years of age, no schooling. (Never used pencil before.)

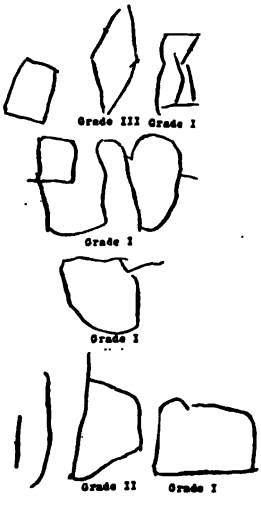


Fig. 24. Copying and drawing from memory by Russian Pole (No. 11 in group), female, 17 years of age, no schooling. (Never used pencil before.)

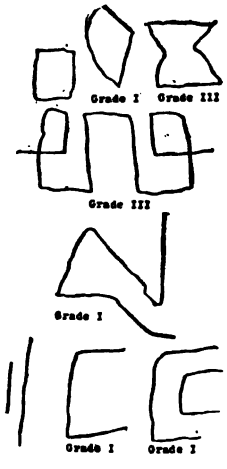


Fig. 25. Copying and drawing from memory by Russian (No. 4 in group), female, 17 years of age, no schooling. (Never used pencil before.)

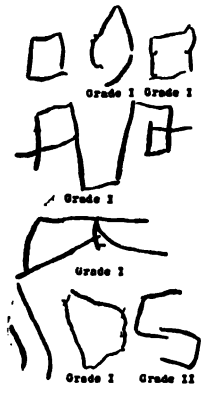


Fig. 26. Copying and drawing from memory by Russian Pole (No. 8 in group), female, 17 years of age, no schooling.

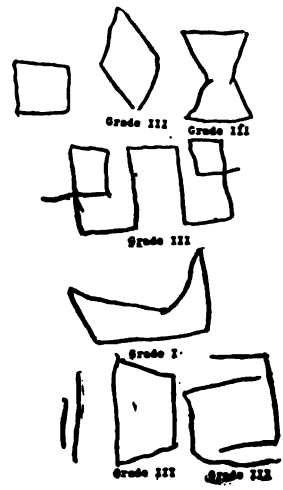


Fig. 27. Copying and drawing from memory by Austrian Ruthenian (No. 19 in group), female, 17 years of age, no schooling. (Never used pencil before.)

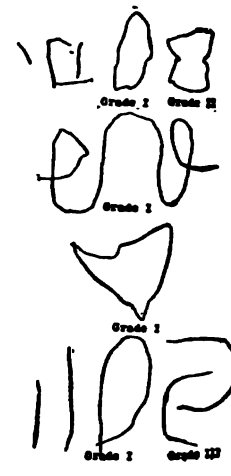


Fig. 28. Copying and drawing from memory by Russian Pole (No. 4 in group), female, 11 years of age, no schooling. (Never used pencil before.)

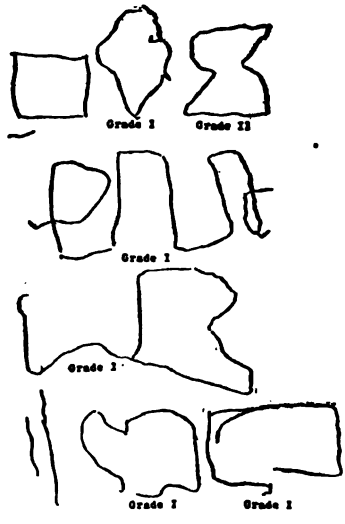


Fig. 29. Copying and drawing from memory by Russian (No. 22 in group), female, 18 years of age, no schooling.

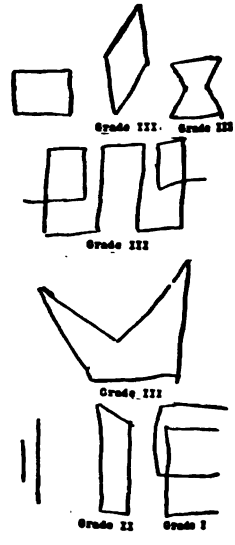


Fig. 30. Copying and drawing from memory by Italian (No. 13 in group), male, 9 years of age, 3 years' schooling.

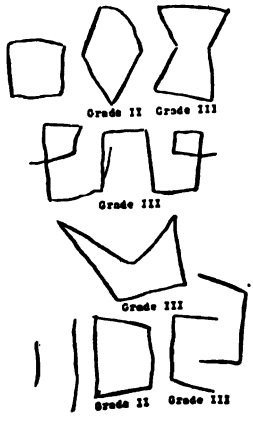


Fig. 31. Copying and drawing from memory by Norwegian (No. 1 in group), female, 9 years of age, 1½ years' schooling.

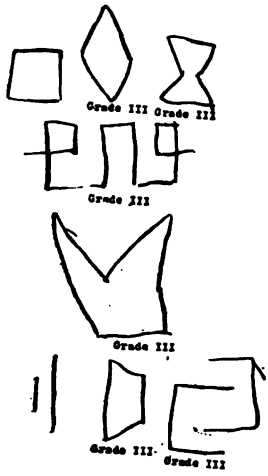


Fig. 32. Copying and drawing from memory by Italian (No. 88 in group), male, 10 years of age, 2 years' schooling.

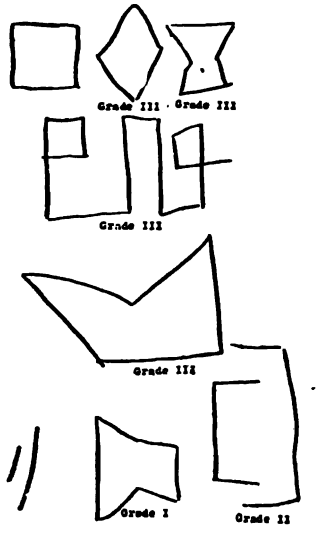


Fig. 33. Copying and drawing from memory by Italian (No. 85 in group), male, 10 years of age, 1 year schooling.

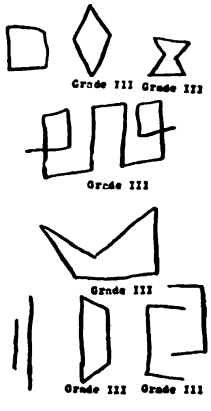


Fig. 34. Copying and drawing from memory by Dane (No. 1 in group), female, 10 years of age, 4 years' schooling.

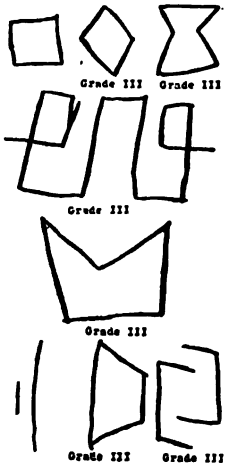


Fig. 35. Copying and drawing from memory by Turkish Greek (No. 9 in group), female, 10 years of age, 3 years' schooling.

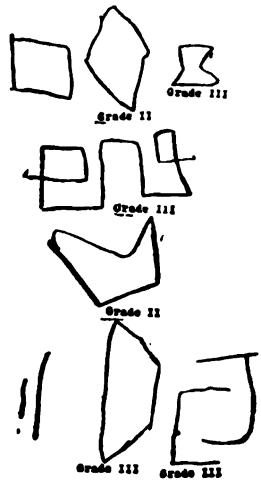


Fig. 36. Copying and drawing from memory by Russian (No. 16 in group), male, 10 years of age, no schooling. (Alien said, "A boy showed me how to use a pencil.")

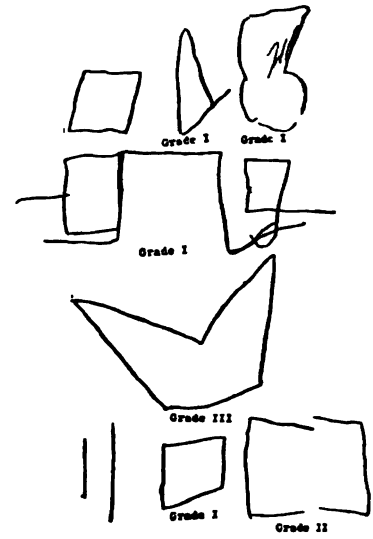


Fig. 37. Copying and drawing from memory by Russian Hebrew (No. 7 in group), female, 10 years of age, no schooling.

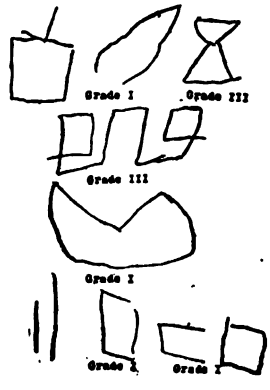


Fig. 38. Copying and drawing from memory by Russian Hebrew (No. 1 in group), female, 11 years of age, no schooling.

Fig. 39. Copying and drawing from memory by Russian (No. 17 in group), female, 11 years of age, no schooling. (Never used a pencil before.)

TABLE 24.—*Results of Copying from Memory Tests.*

Group.	Number examined.	Number of aliens making the different grades.						Averages.				
		Trapezoid.			Interlocking figure.							
		Grade 3.	Grade 2.	Grade 1.	Grade 3.	Grade 2.	Grade 1.	3	2.50	2	1.50	1
Literates:												
9-11	12	8	2	2	10	1	1	8	1	1	2	....
Hebrew 9-11	25	18	1	6	17	5	3	11	5	8	1	....
12-14	37	30	3	4	22	4	11	21	3	7	4	2
15-above	100	80	7	13	67	13	20	57	16	17	4	6
Illiterates:												
10-11	4	2	.....	2	2	1	1	2	.....	....	1	1
12-14	8	2	1	5	4	1	3	2	.....	2	2	2
15-above	29	15	5	9	16	4	[1] 8	10	7	4	1	7
Italian—												
Men	20	13	.....	7	6	7	7	6	4	3	3	4
Women	20	5	1	14	7	1	12	4	.....	4	2	10
Slav—												
Men	10	4	1	5	8	.....	2	4	.....	4	1	1
Women	30	13	1	16	16	6	[2] 7	9	2	9	5	4

[1] One drawing not recorded. [2] One alien in this group did not draw the interlocking figure.

SUMMARY OF RESULTS.

In copying, the majority of immigrants made an average grade for the four drawings of at least 2. The average grade 3 was made more often than any other single grade. The literates excelled the illiterates. The men of the *Italian illiterate* group excelled the women, the women of this group making the poorest showing of all groups or subgroups in this test. The bent-wire figure was copied with more success than the other designs. The allied-Ziehen figure was copied with the least success.

In drawing from memory, the majority of immigrants made an average grade for the two drawings of at least 2. However, as many women of the *Italian illiterate* group and children of the illiterate groups fell below grade 2 as above it. As would be expected, the literates excelled the illiterates in this test.

The literates were a little more successful in drawing the trapezoid than they were in drawing the interlocking figure, while the illiterates, doing a poorer grade of work, did equally well with both drawings.

DISCUSSION.

A glance at the above actual drawings will prove that formal schooling is the greatest factor in the successful performance of these two tests. Only a small amount of schooling, even two or three months, renders the alien capable of doing these tests comparatively well.

In some instances, where illiterate immigrants made a good grade in these tests, it was found that they had handled a pencil before, although they had never learned to write.

At many institutions for the feeble-minded are to be found specimens of fine drawing, executed by the inmates, which undoubtedly are the result of practice. Many immigrants who made a poor showing in these tests, whose drawings would be considered the productions of an idiot by an inexperienced person, made good records on other tests.

It is certain that if a diagnosis of mental defect was to be made on drawing ability alone, many intelligent immigrants would be excluded. Hence it may be concluded that in the mental examination of an arriving immigrant a poor drawing means nothing in itself.

Whenever an immigrant copies poorly or fails at memory drawing, it may be well to ascertain whether he has been to school, and if so, how long; whether he has tried to draw or write with a pencil at home. It would be well to give him a number of trials in drawing at the same and at subsequent examinations in order to get an idea of his learning ability in this direction. If an immigrant has attended school and has had every opportunity to learn to write and then executes a poor drawing, defect in the subject's analytic and visual retentive powers would be suspected.

Some immigrants made grade 1 in certain drawings, but redeemed themselves in making higher grades with the others. Just as in any other test, a temporary emotional disturbance or some accidental cause at times may be productive of low-grade work. Hence every detail on a drawing chart should be considered and weighed in connection with the previous experience of the individual.

It is thought that certain occupations among immigrants give a training in form perception which materially assists in the execution of drawing tests. Two illiterate Ruthanian girls (Nos. 20 and 21), who had never held pencils in their hands before, did well in drawing. They wore jackets, the sleeves of which were decorated with different colored geometrical figures which they had embroidered. It is probable that this training in embroidering was of much assistance to them in executing these drawing tests.

During the execution of these tests a number of peculiarities in the manner of holding the pencil and manner of executing the drawing were observed.

TRANSITIONAL TESTS (NONARITHMETICAL).

ENUMERATING DAYS OF WEEK BACKWARD.

After enumerating the days of the week, the subject was requested to recite them in the reverse order. He was allowed two trials.

The results are given in the following table:

TABLE 25.—*Result of Enumerating Days Backward Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	12	11	91⅔	10–11	4	2	50	Italian—Women.	19	13	68+
Hebrew, 9–11	25	25	100	12–14	8	7	87½	Slav:			
12–14	37	35	94⅓+	15, above	27	24	89 —	Men	10	9	90
15, above	100	99	99	Italian—Men	20	17	85	Women	30	29	96

The *illiterate 10–11* and women of the *Italian illiterate* group did poorly in this test. Seventy-five per cent of the members of all the other groups succeeded. The only failure in the *literate 15 and above* group was a male Armenian, 19 years old, who had attended school 10 years and who averaged well on the other tests.

DISCUSSION.

In this test is involved the conversion of a fixed association into a demand association. The order of week days has to be reversed by the subject. It is a new demand upon him; in many cases he has never done it before. There are several mental processes by which he can come forth with the correct response. The sagacity of the normal immigrant enables him to select a method, and by voluntarily attending to the method he accomplishes the task. One method is to enumerate to oneself the days of the week in the regular order, to pronounce aloud and retain the last day thus enumerated, and to repeat this method until the task is completed. Another method is to break up a fixed series into parts and to recite to oneself an association combination such as "Wednesday, Thursday, Friday," and immediately reversing it in telling it to the examiner. This method would be repeated until the task is finished.

On a second examination to test controlled associative power (thinking power) the days backward or any test previously used should not

be selected. If possible, a new problem should be selected, one which will make the subjects analyze and rearrange their fixed associations.

Counting backwards, spelling words backwards, enumerating the months in a reverse order, being in the nature of new problems, would more easily enable the examiner to determine the presence and quality of controlled associative power than a test in which the subject had perhaps been coached since the first examination.

OPPOSITES.

Opposites were used in this experiment at the suggestion of Prof. R. S. Woodworth, Department of Psychology, Columbia University. Eight simple words were selected. The subject was asked to give words that were opposites of these 8 words.

METHOD OF TESTING.

The interpreter selected 4 words—man, day, good, inside—and repeatedly gave the opposites of them in order that the immigrant could comprehend what the test required. For instance, looking directly at the immigrant and moving his hand from side to side, the interpreter would say: "The opposite of man is woman. The opposite of woman is man. Man-woman, woman-man, man-woman." After explaining the opposites of the remaining words in the same way, he would go through the same 4 words again and again, frequently getting the immigrant to supply the correct opposite. It usually required three or four minutes for the immigrant to grasp the idea of the test.

The test proper then began by asking the immigrant "What is the opposite of cold?"

If an immigrant gave an incorrect reply or if he hesitated unduly long, the same question was again put to him. His reply was then written down on his examination chart, and he was immediately tested with the next word, "high."

The following 8 words were used in this test[1] in the order given:

cold	yes	sick	boy
high	rich	up	winter

"Hot" and "warm" were considered the correct opposites of "cold"; "girl," "man," "grown-up person" were considered correct opposites of "boy"; "healthy" and "healthy person" were considered correct opposites of "sick."

[1] The following words, in addition to those used in the experiment, were proven to be the easiest in a list of 40 opposites (Woodworth suggests that they be substituted, 8 at a time, in the event of a second or third examination): Out, white, slow, above, north, top, wet, front, long, east, big, and love.

RESULTS.

The results are contained in the following table:

TABLE 26.—*Results of Opposites Test.*

Group.	Number examined.	5 or more correct answers.					Less than 5 correct answers.					
		Number of aliens.				Percentage.	Number of aliens.					Percentage.
		8 correct answers.	7 correct answers.	6 correct answers.	5 correct answers.		4 correct answers.	3 correct answers.	2 correct answers.	1 correct answer.	0 correct answers.	
Literates:												
9–11	12	7	3	1	1	100	.....	.....	.....	.....	.....	0
Hebrew, 9–11	25	20	3	1	1	100	.....	.....	.....	.....	.....	0
12–14	37	17	11	2	2	86½	2	1	1	1	.....	13½
15-above	100	59	22	14	1	96	2	.....	.....	.....	2	4
Illiterates:												
10–11	4	1	2	1	.....	100	.....	.....	.....	.....	.....	0
12–14	8	5	.....	2	.....	87½	.....	.....	.....	.....	1	12½
15-above	27	13	6	2	2	85 +	.....	1	3	.....	.....	15 −
Italian—												
Men	20	2	5	5	.....	60	1	2	2	2	1	40
Women	20	1	2	1	1	25	.....	2	1	9	3	75
Slav—												
Men	10	3	3	3	.....	90	.....	1	.....	.....	.....	10
Women	30	5	10	11	3	96⅔	1	.....	.....	.....	.....	3⅓

It will be seen that, with the exception of the *Italian illiterate* group, 75 per cent of every group succeeded in giving the correct opposites in 5 out of 8 cases. Although the men of the *Italian illiterate* group dropped below the 75 per cent mark, they excelled the women. The *Slav illiterate* group made an excellent showing, the women excelling the men.

DISCUSSION.

This test was given at the end of the examination, and in a general way the result may be said to be in part an index of mentation after one and one-half hours of continuous mental work.

On the whole, average immigrants above the age of 9 do well in this test after it has been properly explained to them. The test had been tried at Ellis Island a number of times during the past few years but always with unsatisfactory results. It is now thought that in all the trials which proved unsatisfactory the preliminary explanation was at fault. It is important to emphasize that the interpreter in explaining must go over and over the sample words with the immigrant until the latter understands the nature of the test.

After this test is tried on a number of immigrants the examiner will become familiar with the comprehension power of the normal subject. In the preliminary explanation, when simple words are used, the rapidity with which the subject understands what is wanted of him is perhaps an index of his comprehension power.

This is a test in controlled association and permits of slight if any variation in the reply.

Should this test be used at repeated examinations, it is obvious that a series of new words would have to be used (see footnote, p. 74). Familiarity with the test and learning ability should enable the immigrant to make a better score at the second examination than he does at the first.

Many immigrants showed that their mentation was striving in the right direction, even if they did not name the exact opposite. Examples of this kind were "female" for the opposite of "boy," "winter" for the opposite of "spring." Careful attention to mistakes of this kind is necessary on the part of the examiner and will assist in differentiating lack of native ability from ignorance.

Many of the Russians, and more especially the Ruthenians, failed on the opposite of "yes." It is certain that their score would have been higher had another simple word been substituted.

FIVE ANIMALS.

The ability to recognize the pictures of animals was tested by placing pictures of a horse, cow, pig, donkey, and dog [1] in succession in front of the immigrant and exposing each picture sufficiently long for the alien to name the animal which was represented.

This test was performed on a comparatively small number of immigrants. Forty could not be included as they had been given the Inverted Picture Test. (See p. 77.)

The test was considered a failure if a single mistake was made.

RESULTS.

The results are given in the following table:

TABLE 27.—*Results of Five Animals Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	8	6	75	10–11	2	2	100	Italian: Women	12	9	75
Hebrew, 9–11	20	8	40	12–14	6	5	83⅓	Slav:			
12–14	30	24	80	15-above	19	13	68+	Men	10	7	70
15-above	69	58	84+	Italian; Men	14	10	71+	Women	25	8	32

DISCUSSION.

Owing to the small number of subjects examined no definite conclusions should be drawn from this test in regard to the results obtained by the different groups. It is safe to say, however, that to give correctly the names of the 5 animals here presented is not altogether an easy matter for immigrants.

[1] A picture of a St. Bernard dog was used.

In order to recognize the animals portrayed, the immigrant must be familiar with them, and must be able to make a discrimination between these animals and those of similar appearance. It is possible that some have never seen dogs similar to the one here pictured.

Many of the failures were due to the fact that the alien was not sufficiently specific in his reply, as when he said horse for donkey. This was the most common mistake. It may sometimes have been due to the fact that he had never seen a donkey.

The following are examples of the mistakes made, the name to the left indicating the picture:

cow { bull. / ox. / steer.

donkey { colt. / mule. / little horse.

dog { tiger. / wolf. / lion. / bear. / cat.

pig { buffalo. / ox. / cow. / deer.

The picture of the horse is the only one about which no mistake was made. The pig was called ox, cow, and deer by three children of the *Hebrew literate* group.

INVERTED ANIMALS.

The pictures of 5 animals—horse, cow, donkey, pig, dog—were presented in an up-side-down position in order to see if this baffling[1] would interfere with the immigrant's perceptive powers.

A mistake in naming 1 animal was sufficient for the whole test to be considered a failure. Twenty-six out of 40 immigrants tested succeeded in making the correct perceptions in the case of all 5 animals. Practically all of them succeeded in correctly naming 3 or 4 of the animals. This ability to name the pictures of these animals correctly when in an up-side-down position was found in several immigrant children of 3 and 4 years of age. What was said in regard to the Animal Recognition Test is likewise applicable to this test.

The tabulated results follow:

TABLE 28.—*Results of Inverted Animals Test.*

Literates.				Illiterates.			
Group.	Number examined.	Number successful.	Percentage successful.	Group	Number examined.	Number successful.	Percentage successful.
11	4	3	75	12–14	1	1	100
ebrew 9–11	8	4	50	15–above	3	2	66⅔
1–14	8	6	75	Slav women	5	3	60
-above	11	7	63⅓				

[1] A purposive attempt to interfere with perception.

COLORS.

The ability to recognize colors was determined by placing 4 colored cards—red, black, green, yellow—in front of the immigrant and getting him to name the colors.

RESULTS.

The results are given in the following table:

TABLE 29.—*Results of Color Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	12	11	91⅔	10–11	4	4	100	Italian: Women	20	18	90
Hebrew 9–11	26	22	88	12–14	8	7	87½	Slav:			
12–14	37	35	94½+	15–above	27	24	88½+	Men	10	8	80
15–above	98	87	88½+	Italian: Men	20	16	80	Women	20	21	70

DISCUSSION.

When a failure occurred, it usually pertained to one color. Exceptionally the subject failed in giving the color of two cards. An example of this was the fifth man of the *Slav illiterate* group. This man gave pink for red and blue for green. Some of the mistakes were the calling of—

Brown, Cloth, Coffee, Dark, Gray, Indigo, Lead	instead of black.	Blue, Chestnut, Heavenly, Violet, Yellow	instead of green.
		Blue, Pink, Yellow	instead of red.

The most frequent mistake was to give another color for green. It is thought that the mistakes were more often due to ignorance than to a real lack of discriminative ability; however, color blindness probably played an important part where mistakes were made.

Seventy-five per cent of every group, except the women of the *Slav illiterate* group, succeeded in correctly naming the four colors.

It is interesting to note that the women of the *Italian illiterate* group excelled the women of the *Slav illiterate* group. They also excelled the men of their own group, as well as the men of the Slav group. A fact worth noticing also is the perfect record made by the 4 members of the *illiterate 10–11* group.

COINS.

Each immigrant was questioned as to how many small coins of his country were equivalent in value to a large coin. For instance, Italians were asked, "How many soldi constitute a lire?" Russians were asked, "How many kopecks are equivalent to a ruble?" Ruthenians were questioned as to the number of kritzas that could be exchanged for a gulden.

From the following table it will be observed that at least 75 per cent of every group succeeded in giving the correct answer to this question:

TABLE 30.—*Results of Coin Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	12	12	100	10–11	4	3	75	Italian: Women	20	18	90
Hebrew, 9–11	25	25	100	12–14	8	7	87½	Slav:			
12–14	37	35	94½+	15-above	27	27	100	Men	10	10	100
15-above	99	98	99 —	Italian: Men	20	20	100	Women	30	25	83⅓

WEIGHTS.

The ability to discriminate weights was tested by placing 5 cubes of different weights on the examining table in front of the subject and getting him to arrange them in order of their weight. Two trials were allowed.

The cubes were made of wood, were a little more than 1 cubic inch in size, and contained different quantities of lead in their interior. Their weights were as follows: 12.3 grams, 16.8 grams, 22 grams, 24 grams, 38.2 grams.

The results were as follows:

TABLE 31.—*Results of Weights Test.*

Group.	Number examined.	Number successful.			Percentage successful.	Group.	Number examined.	Number successful.			Percentage successful.
		Trial 1.	Trial 2.	Total.				Trial 1.	Trial 2.	Total.	
Literates:						Illiterates—Con.					
9–11	12	12	.....	12	100	15, above	27	19	5	24	89 —
Hebrew, 9–11	25	19	6	25	100	Italian—					
12–14	37	28	7	35	94½+	Men	20	14	5	19	95
15-above	99	75	17	92	92½+	Women	20	15	1	16	80
Illiterates:						Slav—					
10–11	4	4	.....	4	100	Men	10	7	3	10	100
12–14	7	6	1	7	100	Women	29	21	5	26	89½+

It will be noticed that 75 per cent of the immigrants of every group succeeded in this test. Perhaps the most interesting result is that, of

41 immigrants under the age of 12, all succeeded. Above the age of 9 it would appear that the ability to arrange these weights is independent of age and formal schooling.

DIFFERENCE BETWEEN A HOUSE AND A STABLE.

Each immigrant was asked "What is the difference between a house and a stable?

If the essential idea that a house is for people and a stable is for animals or for certain kinds of animals was expressed or implied, the test was considered as having been satisfactorily passed.

Satisfactory replies by certain illiterates are here given exactly as translated by the interpreter:

Is the wall between. Stable is used for the donkey; house is used for the furniture, seats, trunks, and people. (Italian, age 16, male.)

House is where we live and have our kitchen; stable is where we have our animals. (Italian, age 18, male.)

House where we live and where there is furniture; in the stable the cattle eat and sleep. (Italian, age 18, male.)

House is to eat in and sleep in; stable is to put horses in. (Italian, age 21, male.)

There is a great difference; the stable is not like the house; (further pressed) house is to live in, stable is for beasts. (Italian, age 23, male.)

In the one people live; one is for the animals. (Italian, age 24, male.)

Much difference; stable all the domestic animals sleep. Human beings sleep in the house. (Italian, age 27, male.)

House is for persons and the stable smells bad (difficult to classify). (Italian, age 27, male.)

The difference in my house is the family lives upstairs, stable is underneath. (Difficult to classify.) (Italian, age 29, male.)

The following are some of the unsatisfactory replies made by illiterates:

You are here and the stable is out there. (Italian, age 16, male.)

House is bigger and finer than the stable. (Italian, age 19, male.)

The neatness, the cleanliness. (Italian, age 25, female.)

To have rooms, for stabling. (Italian, age 25, female.)

House is to sleep in, and the stable is where we throw the filth. (Italian, age 25, female.)

House has a floor, stable has not. (Russian Ruthenian, age 22, male.)

In home there are chimney, stove, and windows, there are none in the stable. (Russian Pole, age 28, male.)

Same building, house is better looking, stable is not good looking. (Austrian Ruthenian, age 16, female.)

House is being blessed, stable is not. (Russian, age 20, female.)

In the house we are living. (Russian, age 20, female.)

House has windows, stable has none. (Russian, age 27, female.)

Stable is dirty, house is clean. (Spaniard, age 18 male.)

House is where you live, table is in the house. (Roman, age 25, female.)

The wall is between the house and the stable. (Spaniard, age 27, male.)

House is clean, stable is full of dirt. (Spaniard, age 42, male.)

House has a roof, stable has not. (Russian Hebrew, age 10, female.)

Stable is dirtier, no other difference. (Italian, age 12, male.)

TABLE 32.—*Results of test regarding difference between house and stable.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	12	10	83⅓	10–11	4	3	75	Italian: Women	20	17	85
Hebrew 9–11	24	22	91⅔	12–14	8	7	87½	Slav:			
12–14	37	32	86½	15-above	27	23	85+	Men	10	8	80
15-above	99	84	84½	Italian: Men	20	18	90	Women	30	26	86⅔

CHRISTMAS OR PEYSACH.

The question "What is Christmas?" or in the case of Hebrews "What is Peysach?" was put to each individual. Replies embodying the ideas "birth of Christ" or "the deliverance of the Jews from Egyptian slavery" were considered correct.

Many immigrants responded by saying "I don't know." Of other incorrect replies, the following are given to show how some average or normal immigrants responded to the question:

What is Christmas?

Illiterates:

Italian (male, age 13): After Christmas comes summer.
Italian (male, age 14): Grand feast all over the world.
Spanish (male, age 16): Holiday, souls are then on a journey.
Spanish (male, age 16): Feast of Christmas.
Russian Hebrew (female, age 17): Holiday once a year.
Spanish (male, age 18): They have a great feast.
Spanish (male, age 27): It is a great feast when we eat well for 3 or 4 days.
Spanish (male, age 31): Last month in the year.
Spanish (male, age 31): When Christ arose.
Spanish (male, age 32): That is when we eat and drink well.
Spanish (male, age 39): Feast of holiday.
Spanish (male, age 42): It is in remembrance at the end of the year, great feast.
Italian (male, age 16): A grand feast.
Italian (male, age, 16): Feast of Jesus, when relatives reunite.
Italian (male, age 18): Feast.
Italian (male, age 19): Holiday, eat more than on other days.
Italian (male, age 20): A feast in which a variety of sweet things are made.
Italian (male, age 21): A feast which you call Christmas.
Italian (male, age 23): Great holiday.
Italian (male, age 24): 25th of December.
Italian (male, age 24): Feast of Our Lord, Jesus.
Italian (male, age 30): Holiday.
Italian (male, age 30): Child was born.
Italian (female, age 16): Make a great feast.
Italian (female, age 19): Good feast.
Italian (female, age 20): It is a great feast in which we eat, drink, and are happy.
Italian (female, age 24): Grand feast.
Italian (female, age 25): Great holiday.
Austria Ruthenian (male, age 16): They bless the waters then.

Illiterates—Continued.

Russian (male, age 18): It is a great holiday.
Russian Pole (male, age 20): Have to go to church and pray.
Russian Ruthenian (male, age 22): Certain religious services.
Austria Ruthenian (male, age 24): Jesus was tortured.
Russian Pole (female, age 17): A holiday for the whole year.
Russian (female, age 17): Great holiday, bless the food.
Russian (female, age 18): Christ suffered.
Austria Ruthenian (female, age 18): Christening of Christ.
Russian (female, age 20): Ascension of Christ.
Russian (female, age 20): A great holiday.
Austria Ruthenian (female, age 20): Christ has risen.
Austria Ruthenian (female, age 23): Christ's supper.

What is Peysach (substituted for Hebrews)?

Literates:

Russian Hebrew (male, age 9): Because the Jews in Egypt had a hard time and did not eat the right bread.
Russian Hebrew (male, age 10): We left Egypt then.
Russian Hebrew (male, age 10): Not allowed to eat bread.
Russian Hebrew (female, age 10): We go to the synagogue and eat matzoth.
Russian Hebrew (female, age 10): Jews have been in Egypt and ate unleaven bread.
Rusian Hebrew (female, age 10): Because we are Jews.
Russian Hebrew (female, age 10): Making biscuits.
Russian Hebrew (male, age 11): When the Jews escaped from Egypt they took dough and baked it without waiting for it to ferment.
Russian Hebrew (female, age 11): Jews ate in Egypt unleaven bread.

The following table shows the low percentage of correct responses in each group:

TABLE 33.—*Results of Christmas or Peysach Test.*

Literates.				Illiterates.							
Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.	Group.	Number examined.	Number successful.	Percentage successful.
9–11	12	8	66⅔	10–11	4	1	25	Italian: Women	20	13	65
Hebrew 9–11	25	10	40	12–14	8	2	25	Slav:			
12–14	37	25	67½+	15-above	26	8	30½+	Men	10	4	40
15-above	97	67	69+	Italian: Men	20	11	55	Women	30	17	94

The above table shows that no group succeeded in this test.

The illiterates performed the test almost as satisfactorily as the literates. The ability to express ideas in suitable words has much to do with success in a test of this kind, and it would seem that the small amount of schooling which the literates have generally received is of little benefit to them in expressing their ideas. In some instances the replies will show what is uppermost in the subject's mind as well as his small amount of experience. Many of the responses bring out the observation power and conceptual power of untrained immigrants.

TESTS IN REASONING (NONARITHMETICAL).

GEOGRAPHIC PUZZLE.

The Geographic Puzzle, evolved at Ellis Island several years ago from a series of similar cardboard puzzles, is one of the first puzzle tests used in connection with the mental examination of arriving immigrants. It is typical of a large class of puzzles. The Geographic is a simple jig-saw puzzle,[1] and in its united form is 6¾ inches long, 4¼ inches wide, and about ⅜-inch thick. (The exact dimensions are unimportant.)

This puzzle consists of a body or central part irregularly indented by 6 eccentric clefts, and 6 pieces, each having 1 or 2 straight margins and an eccentric curved margin. The 6 pieces fit into the 6 clefts of the body, so that when all 7 parts are together a rectangular figure is formed. Figures 40–42 show the shape, arrangement, and relative size of the pieces.

METHOD OF TESTING.

The body of the Geographic Puzzle was placed on the examination table in front of the immigrant, with its lower border near him. The 6 pieces were placed together at the right of the puzzle, 3 pieces resting on their anterior polished surfaces and 3 on their posterior rough surfaces. The experimenter told the subject to watch closely while he slowly took piece 1 from the pile and placed it in its proper position, that is, in the cleft of the lower border. The experimenter likewise placed pieces 2 and 3 in their proper clefts. (Fig. 42.)

After permitting the alien to observe the half-completed puzzle for three or four seconds, the puzzle was disarranged and put aside. The subject's attention was then taken from this puzzle by using the counting-dot experiment. (See 44.) Immediately after the immigrant had counted the dots, the Geographic Puzzle was again placed in front of him, this time in a reversed position, so that cleft 4 was near the alien. The pieces were placed indiscriminately, three resting on their anterior surfaces and three on their posterior surfaces.

The alien was instructed to place the pieces in their proper clefts. Time was taken with stop watch from the second the subject touched the first piece until the puzzle was successfully completed, and all false moves made by the subject were carefully counted. Inability to complete this puzzle in five minutes (300 seconds) was considered failure. If the subject approached a certain cleft with the wrong piece, then remained still, reflected, and returned the piece to the pile, he was not credited with a false move. It would be considered a false move only when the piece actually entered the cleft. A piece

[1] This and similar puzzles can be made by scroll saw out of maple, ash, or other woods.

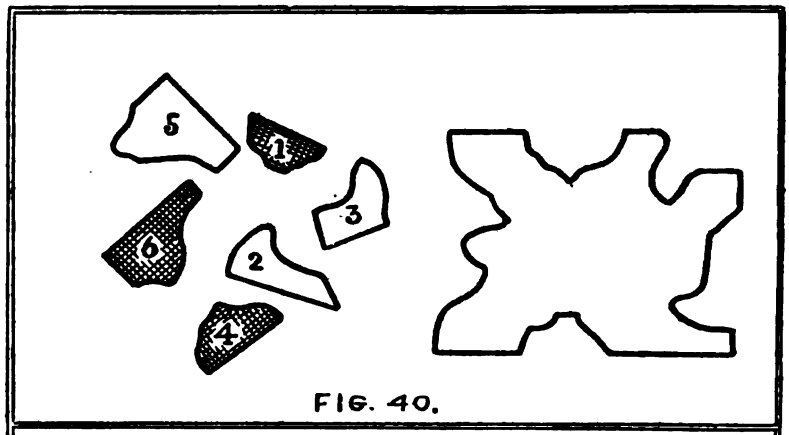


FIG. 40.

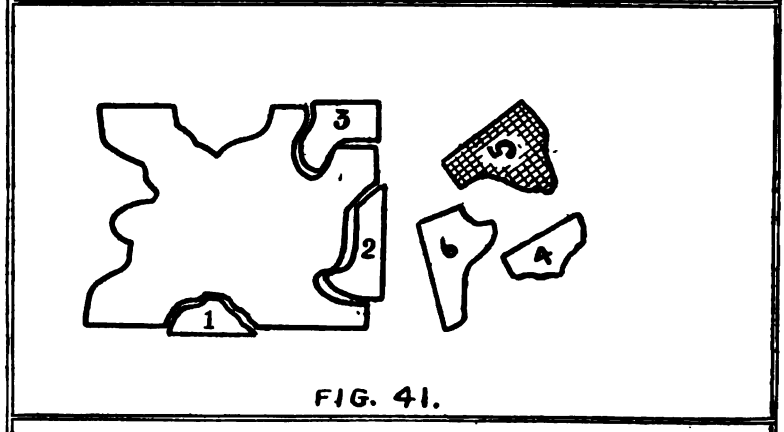


FIG. 41.

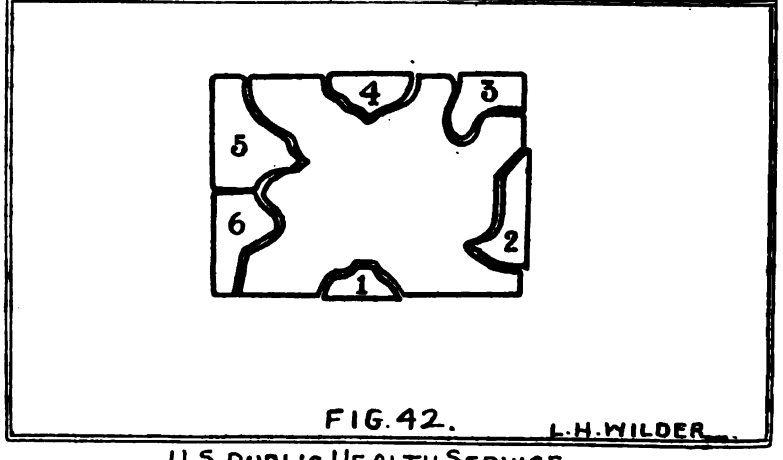


FIG. 42. L.H.WILDER

U.S. PUBLIC HEALTH SERVICE.

FIG. 40.—Geographic puzzle, as presented to immigrant for solution.

FIG. 41.—Geographic puzzle with first three pieces in their proper clefts. Immigrant was shown puzzle in this form before he commenced to solve it, after which it was disarranged.

FIG. 42.—Geographic puzzle, with pieces in their proper clefts.

(Lined pieces are wrong side up.)

placed in its proper cleft on its posterior or rough surface instead of on its anterior polished surface was recorded as a false move.

In exceptional cases, when the puzzle was almost completed in 300 seconds, the alien was permitted to finish it, the few additional seconds being also recorded, though the performance was scored as a failure. If the immigrant failed in 300 seconds or in this additional time, the puzzle was then disarranged, the alien was told to watch carefully while the examiner took each piece from the pile and slowly placed it in its proper cleft in the body of the puzzle.

As soon as the subject had succeeded in working the puzzle, or, in the event of failure, as soon as the examiner had shown him how to do it, the puzzle was immediately disarranged. It was then placed before him exactly as it was presented to him at trial 1, in order to ascertain what improvement a second trial would show.

RESULTS.

The following tables give the detailed results in the case of certain of the groups:

TABLE 34.—*Results of Geographic Test in the case of literate 15 and above group.*

Men (51 examined).							Women (49 examined).						
Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
	Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.				Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.		
1	167	16	100	7	....	....	1	145	15	45	5	....	....
2	26	0	25	0	....	....	2	68	2	30	0	....	....
3	45	5	22	0	....	....	3	140	2	116	2	....	....
4	48	4	33	4	....	....	4	27	2	35	4	×	×
5	75	1	40	0	....	....	5	89	7	40	3	....	....
6	65	1	38	0	....	....	6	42	2	39	2	....	....
7	130	13	37	3	....	....	7	[1] Failed.	29	66	7	....	....
8	54	1	35	0	....	....	8	124	10	32	1	....	....
9	39	0	49	0	×	....	9	105	17	30	2	....	....
10	58	3	49	4	....	×	10	76	3	20	1	....	....
11	117	12	75	5	....	....	11	78	7	21	2	....	....
12	106	3	47	2	....	....	12	75	3	20	1	....	....
13	32	0	94	1	×	×	13	87	10	35	2	....	....
14	63	2	69	6	×	×	14	100	7	46	2	....	....
15	42	6	22	0	....	....	15	27	3	15	0	....	....
16	190	14	29	2	....	....	16	109	10	28	1	....	....
17	78	6	43	0	....	....	17	166	14	56	4	....	....
18	80	6	31	2	....	....	18	72	9	26	2	....	....
19	54	1	23	1	....	....	19	32	3	22	3	....	....
20	29	1	48	4	×	×	20	44	4	43	5	....	×
21	62	5	39	4	....	....	21	53	4	27	2	....	....
22	75	5	23	0	....	....	22	[2] Failed.	35	29	3	....	....
23	74	6	37	3	....	....	23	30	0	24	1	....	×
24	160	10	119	8	....	....	24	24	0	35	3	×	×
25	45	3	23	1	....	....	25	48	2	117	11	×	×
26	48	8	36	7	....	....	26	167	15	126	10	....	....
27	35	1	30	1	....	....	27	37	3	24	2	....	....
28	54	1	50	4	....	×	28	85	7	39	4	....	....
29	106	4	30	0	....	....	29	102	7	34	2	....	....
30	[3] Failed.	35	77	17	....	....	30	91	9	35	1	....	....

[1] Succeeded after 393 seconds.
[2] Succeeded after 303 seconds.
[3] Those who failed at first trial were shown how to put puzzle together before second trial.

TABLE 34.—*Results of Geographic Test in the case of literate 15 and above group—Con.*

Alien's number in group.	Men (51 examined). Trial No. 1. Number of seconds required.	Trial No. 1. Number of false movements made.	Trial No. 2. Number of seconds required.	Trial No. 2. Number of false movements made.	Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Women (49 examined). Trial No. 1. Number of seconds required.	Trial No. 1. Number of false movements made.	Trial No. 2. Number of seconds required.	Trial No. 2. Number of false movements made.	Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
31	59	7	22	1	....	....	31	241	16	37	4	....	....
32	50	6	49	6	....	....	32	45	3	38	3	....	....
33	107	9	75	12	....	X	33	37	0	40	0	X	....
34	77	7	67	4	....	....	34	202	20	108	16	....	....
35	70	9	37	3	....	....	35	41	1	24	0	....	....
36	122	4	106	3	....	....	36	71	7	19	0	....	....
37	37	3	20	0	....	....	37	64	8	20	1	....	....
38	92	3	49	4	....	X	38	35	5	25	1	....	....
39	105	13	52	4	....	....	39	50	7	20	2	....	....
40	62	3	16	0	....	....	40	82	10	163	0	X	X
41	107	2	50	0	....	....	41	187	23	55	7	....	....
42	137	13	50	3	....	....	42	33	1	25	1	....	....
43	40	5	25	1	....	....	43	173	9	22	0	....	....
44	162	18	38	3	....	....	44	82	3	66	5	....	....
45	157	11	154	9	....	....	45	53	7	22	2	....	....
46	79	10	25	0	....	....	46	38	3	23	0	....	....
47	37	2	19	2	....	....	47	38	1	46	4	X	X
48	30	7	15	0	....	....	48	202	22	35	3	....	....
49	55	4	277	23	X	X	49	252	11	82	3	....	....
50	40	0	25	0	....	....							
51	117	15	82	6	....	....							

TABLE 35.—*Results of Geographic Test in the case of Italian illiterate group.*

Alien's number in group.	Men (20 examined). Trial No. 1. Number of seconds required.	Trial No. 1. Number of false movements made.	Trial No. 2. Number of seconds required.	Trial No. 2. Number of false movements made.	Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Women (20 examined). Trial No. 1. Number of seconds required.	Trial No. 1. Number of false movements made.	Trial No. 2. Number of seconds required.	Trial No. 2. Number of false movements made.	Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
1	175	10	35	3	....	....	1	163	13	22	2	....	....
2	67	....	30	....	....	....	2	125	6	26	5	....	....
3	200	20	27	....	....	....	3	Failed.	20	160	9	....	....
4	38	2	26	2	....	....	4	132	10	200	17	X	X
5	119	9	190	23	X	X	5	Failed.	34	46	5	....	....
6	Failed.	33	34	2	....	....	6	94	13	Failed	21	....	....
7	105	9	18	....	....	....	7	188	2	119	2	X	....
8	130	21	45	7	....	....	8	100	13	122	26	X	X
9	184	19	50	3	....	....	9	108	8	43	6	....	....
10	42	4	20	2	....	....	10	56	8	55	13	....	X
11	27	1	40	4	X	X	11	65	11	30	7	....	....
12	109	1	35	1	....	....	12	35	5	37	2	X	....
13	64	7	27	2	....	....	13	247	32	74	11	....	....
14	95	8	45	2	....	....	14	236	17	40	3	....	....
15	163	18	55	3	....	....	15	Failed.	20	45	5	....	....
16	124	12	26	3	....	....	16	152	21	116	16	....	....
17	45	5	26	3	....	....	17	105	15	58	7	....	....
18	75	5	57	3	....	....	18	74	3	29	....	....	....
19	Failed.	54	50	7	....	....	19	49	1	36	11	X	X
20	69	9	15	....	....	....	20	59	4	29	3	....	....

TABLE 36.—*Results of Geographic Test in the case of Slav illiterate group.*

Men (10 examined).							Women (30 examined).						
	Trial No. 1.		Trial No. 2.					Trial No. 1.		Trial No. 2.			
Alien's number in group.	Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.	Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.	Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
1	44	1	24				1	77	9	23	2		
2	49	3	34				2	174	10	26	1		
3	77	7	25	1			3	64	1	55	2		×
4	68	3	30				4	71	9	67	11		×
5	149	8	72	5			5	172	21	34	6		
6	132	6	21				6	68	6	53	8		×
7	128	8	106	7			7	179	18	75	7		
8	51	5	25	1			8	40	2	34	2		
9	56	5	40	2			9	59	6	54	5		
10	30	1	35	1	×		10	163	19	35	3		
							11	44	4	19	1		
							12	108	10	37	1		
							13	184	12	53	1		
							14	58	5	26	3		
							15	58	5	48	4		
							16	59	3	34	3		
							17	82	6	26	2		
							18	59	6	26	2		
							19	34		51	1	×	×
							20	50	3	66	5	×	×
							21	94	11	48	4		
							22	77	7	43	1		
							23	102	14	76	12		
							24	51	3	36	2		
							25	163	4	59	3		
							26	84	10	24			
							27	55	8	53	7		
							28	115	8	47	4		
							29	106	10	39	2		
							30	85	15	84	13		

SUMMARY OF RESULTS.

In the 4 literate groups 174 immigrants were examined, 169, or 97+ per cent, of whom succeeded within 300 seconds at the first trial. The time ranged in all of these successful cases from 23 to 360 seconds. The average time for the literate groups combined was 86 seconds. The best average time (74 seconds) was made by the boys of the *literate 12–14* group; the slowest average time (97 seconds) was made by the *Hebrew literate 9–11 group*.

In the 5 illiterate groups 120 immigrants were examined, 112, or 93⅓ per cent, of whom succeeded within 300 seconds at the first trial. The time ranged from 27 to 272 seconds. The average time for the combined illiterate groups was 102½ seconds. The best average time (78 seconds) was made by the 10 men of *Slav illiterate* group. The slowest average time (127 seconds) was that of the 7 members of the *illiterate 12–14* group.

At the first trial the average number of false moves for the 4 literate groups was 7, the men of the *literate 15 and above* group

making the smallest average (6). The *Hebrew literate 9–11* group made an average of 8.

The average number of false moves for the 5 illiterate groups was 8½, the smallest number (5) being made by the 10 men of the *Slav illiterate* group and the largest number (12) being made, as would naturally be expected, by the *illiterate 10–11* group.

In the second trial all the literates succeeded. One hundred and sixty-eight of them (those who succeeded at trial 1) succeeded in an average time of 45 seconds, the best average time (43 seconds) being made by the 49 women of literate 15 and above group, the slowest average time (51 seconds) by the men of the same group.

In the second trial of the illiterate groups all but one alien succeeded. An Italian woman who succeeded at trial 1 failed at trial 2. One hundred and eleven illiterates succeeded in an average time of 52 seconds, the fastest average time (41 seconds) being made by the 10 men of the *Slav illiterate* group. The slowest average time (76 seconds) was made by the 16 women of the *Italian illiterate* group.

The average number of false moves at the second trial in the case of the literate groups was 3½, each group averaging 3 false moves, except the 19 girls of the *literates 12–14* group, who averaged 4 false moves.

The average number of false moves at the second trial in the case of the 5 illiterate groups amounted to 4½, the largest average number of false moves (8) was made by the 16 women of the *Italian illiterate* group; the smallest average number of false moves (2) was made by the 10 men of the *Slav illiterate* group.

Among the literates the *literate 12–14* group excelled the *literate 15 and above* group in quickness of performance in trial 1. At trial 2 the boys of the *literate 12–14* group excelled the men of the *literate 15 and above* group, while the reverse was true in the case of the girls and women, respectively, of the two groups.

Among the illiterates the *illiterate 10–11* and *illiterate 12–14* groups record the slowest average time in performing the test at trial 1. There is little difference in the performance time of the other groups with the exception of the Italian women, who average a little longer time at the first trial. At trial 2 there is little difference in the average performance time of the different groups—the *Slav illiterate* group making the fastest average time; the women of the *Italian illiterate* group making the slowest time. There is practically no difference in the average number of false moves made by the different literate groups. Among the illiterates the average number of false moves in the *illiterate 10–11* and the women of the *Italian illiterate* groups are largest for trial 1. At trial 2 the women of the *illiterate 15 and above* and *Italian illiterate* groups made the largest average number of false moves. The men of the *Italian illiterate* and the

Slav illiterate groups made the smallest average number of false moves. There was little difference in the number of false moves made by the other groups at trial 2.

In general, among the literate groups the boys and men excelled the girls and women in quickness of performance at trial 1. The boys of the *literate 12–14* group excelled the girls, while the women of the *literate 15 and above* group excelled the men in quickness of performance at trial 2.

In the illiterate groups the average performance time for both trials is faster in the case of the men than in that of the women.

CONCLUSIONS.

As a result of these tests, it may be concluded that:

(1) Seventy-five per cent of the members of each group having successfully performed the Geographic Test, it is therefore not too difficult a test for arriving immigrants above the age of 9.

(2) In the second trial the Geographic and similar tests are performed by arriving immigrants in less time and with a smaller number of false moves than in the first trial.[1]

(3) As a rule, the literate groups succeed in performing the puzzle in quicker time and with fewer false moves than do the illiterate groups.

(4) However, many illiterate immigrants and certain literate groups excel some of the literates.

(5) Generally speaking, above the age of 9 there is no age difference in the performance of this test among literates.

(6) The younger illiterates require a little longer time and make more false moves than the older ones, but even here there is no marked difference in accomplishment.

(7) Among the literate groups the men and boys do slightly better than the girls and women in the performance of the Geographic Test.

(8) Among the illiterates this difference of performance between the two sexes is more marked.

DISCUSSION.

Points of interest in connection with the solution of the Geographic Puzzle are applicable to all form-board puzzles—that is, to those puzzles where small sections fit into recesses in a larger body. This sort of puzzle, however, is somewhat different from the Healy Frame and other puzzles, the successful performance of the latter depending upon a definite construction according to an abstract principle.

In any problem presented for solution there must be present two elements—the known and the unknown. If all elements of a prob-

[1] In both the literate and illiterate groups at trial 2, the average time in solving the Geographic Puzzle and the average number of false moves are approximately one-half what they were at trial 1.

lem are unknown to the subject, the problem can not be solved by him. Some subjects will be able to accomplish a great deal with only a partial knowledge of one or two elements—that is, they will be able to solve a problem if only an inkling or slight familiarity with some of its parts has been previously obtained. Others will require knowledge of many elements before they can enter into the problem and solve it. The variation here indicated in problem solving is simply a variation in reasoning ability.

Although many immigrants had seen puzzles or mechanical contrivances somewhat similar to the Geographic Puzzle, some immigrants, especially the illiterate from rural regions, had never before seen anything like the Geographic Puzzle and others had no previous experience which could be transferred for the purpose of solving this puzzle. It was for this reason that the definite principle of the test was shown to the subject (by placing 3 pieces in position).

In attempting to solve this puzzle the tranquil immigrant with reasoning ability would carefully scrutinize the body of the puzzle with its various shaped clefts and the six different pieces in the pile. He would note that some of the pieces rested on their posterior rough surfaces and others on their anterior smooth surfaces. He would first arrange the two small pyramidal shaped pieces 1 and 4, as their position in the body was most obvious. Then pieces 2 and 3, a little more complicated, but each having its own definite cleft, would be placed. This process of elimination would leave pieces 5 and 6 for final adjustment. The clefts receiving these two pieces coalesce, and therefore the exact positions of pieces 5 and 6 are not so obvious. Perhaps the subject would have to make close and repeated observations of the two remaining pieces and coalescing clefts in order to unravel the difficulty.

This reasoning method was employed by a number of immigrants, and is usually found when the performance time is short and false moves few. Occasionally when the reasoning method was used, a long time was required; but even in these cases the number of false moves were few.

Often, for a brief period normal immigrants used subnormal methods. It is only where the immigrant persists in subnormal methods in trial after trial and test after test that he can be considered subnormal. The animal method (picking up the small pieces at random and attempting to place them without thinking of the similarity between cleft and piece) was used by the majority of immigrants at first. When this method was employed for the first 10 to 20 seconds only it was attributed to emotional disturbances or some other accidental cause. Many intelligent immigrants after attempting for 20 seconds or longer to place the pieces in this haphazard manner would begin to think (to see similarity). They

would then accurately arrange the puzzle piece by piece, completing it in short order. Other immigrants would employ the so-called animal method for 120 seconds or 180 seconds before settling down to purposive thinking.

It is believed that there is no psychological detail in the solving of this puzzle or in the performance of other tests that is too small to mention. Every action that is well done, every movement that shows a purpose, every reply that in any way indicates intelligence, and even the manner and facial expression of the subject should be carefully observed. It is only by paying strict attention to all these little details, by weighing them, and by inquiring into the whys and wherefores of unsatisfactory performances that a correct judgment as to the normality of an immigrant at the time of landing can be reached.

As said above, at the second trial the performance time and false moves were as a rule reduced. A frequent exception to this rule is where the first trial is done with speed and accuracy, in which case a comparatively poor showing may occur at trial 2. An "ambitious" attitude may be the cause of a comparatively poor showing. One alien who solved the test very quickly with no false moves, ambitious to outdo the previous performance, made an extremely poor showing at the second trial. A self-conscious attitude, a feeling that he is on trial, a feeling that disaster may result to him in the event of failure, and other attitudes are accountable for the poor showing that several normal aliens made.

Success is delayed in some cases owing to the immigrant assuming that a certain segment of the puzzle should go into a certain cleft regardless of whether the segment and cleft are similar in form. A Lithuanian girl strove hard and well to perform this test but was acting under a similar wrong assumption. After some preliminary maneuvering the pieces lay on the table with their rough surfaces uppermost. The girl temporarily assumed that they were to enter the clefts just as they were. It did not occur to her to turn them over. False assumptions like this have cost different subjects anywhere from 30 to 120 seconds.

In doing the second trial of the puzzle one immigrant placed the first 5 pieces in their proper places in 3 seconds, then became disturbed and spent 30 seconds in placing piece 6 in its proper cleft.

After taking a long time to work the puzzle and after making many false moves some immigrants do rapid and excellent work at the second trial. These cases profit by experience and this in itself is a sign of intelligence.

In performing this test one of the greatest causes for delay on the part of the immigrant is the selecting at the start of a large piece instead of one of the small pyramidal pieces. One immigrant

tenaciously held on to 1 segment, looking at it for a long time in a perplexed way. Others attempt to place 2 segments in the body of the puzzle at the same time. This usually results in delay.

Attempting to put a segment into an impossible cleft is not always a sign of mental defect, but occasionally occurs in a normal person when temporarily disturbed.

In extreme cases an immigrant may attempt the test as though all thought were paralyzed. He continues to put every piece in every cleft regardless of whether similarity between cleft and piece exists. Later he may wake up and solve the puzzle quickly, or this dazed mental condition may persist throughout the entire five minutes. Still he may be of normal intelligence, which is proven by his excellent correlations in other tests.

In these particular cases the immigrant's attention may be internally directed. It may be strongly riveted on some anticipation, disappointment, or other affair, and at such a time his intellectual field is not doing itself justice. This mental state is by no means uncommon in the normal immigrant at the time of arrival.

In some cases an immigrant will pick up 3 wrong segments in succession and endeavor to place them in a certain cleft, then he will pick up the right segment and instead of putting it in the cleft in question, will attempt to put it in another cleft.

A Russian (No. 21) d d the test in 32 seconds with no false moves. During the second trial he was distracted by the ringing of bells and he succeeded only after 94 seconds and after making a false move. A Spaniard (No. 4) did the test well on the first trial; then he became much disturbed. At the second trial he could not properly place a single segment. He exclaimed, "I am going to pieces on account of my trouble."

At times, when disturbed, an immigrant has removed a piece after it had been properly placed in the body of the puzzle.

In the performance of this and other tests the attention may wander. The subject may look out of the window, stare at some object in the room, or assume a perplexed look. A feeling of uncertainty as to what it all means, fatigue, disappointment at not immediately being landed are accountable, singly or severally, in different cases for such behavior.

Better results can always be obtained in working this and similar puzzles if a large table upon which the subject can rest his arms is used.

Many failures in this as well as in other puzzle tests are undoubtedly due to defective vision. In order to perform this test successfully, as well as the Relationship Test (see p. 102), a broad visual field is necessary so as to take in at a glance the body of the puzzle with its

clefts as well as the pile containing the variously shaped pieces. Two intelligent immigrants with an extremely narrow visual field had much difficulty in doing the test. They could see only one cleft at a time, and then shifting their gaze to the pile, could see only one piece at a time. In attempting to perform this test they had to shift a piece from cleft to cleft, each time closely observing the particular cleft. These same two aliens performed the Healy Frame Test (see below) with ease. It may be well to reiterate that occasionally all sorts of abnormal symptoms are encountered within the range of normality. On account of their learning ability the normals show much improvement in doing this test at the second trial.

The immigrants who have made a poor showing at both trials in this particular experiment have retrieved themselves in the successful performance of other tests, both concrete and abstract. It must be distinctly remembered that this discussion is limited to a single examination for a given individual. Many peculiarities here noted would probably not occur at a second examination on the following day.

HEALY'S CONSTRUCTION TEST A.

The Healy Frame Test devised by Dr. William Healy, of Chicago, has been extensively used at immigration stations in the mental examinations of aliens for the past two and one-half years. The test is a construction problem and consists in arranging 5 small pieces so as to fill completely the interior of a frame. As used in this experiment the part of the test within the frame measures 4 inches long and 3 inches wide, the recess which received the 5 pieces and consequently the pieces themselves being less than one-fourth of an inch thick. It is important that the individual pieces should be less than one-fourth of an inch in thickness, because in testing immigrants it has been found that the thicker the individual pieces the more difficult is the task of performing this test. It is important that piece 1 (see fig. 43) should be distinctly broader than any other piece. In the present test piece 2 was a little broader than piece 3, and pieces 4 and 5 were of the same dimensions, each being a trifle broader than piece 2.

The illustrations (figs. 43–45) show the test as presented, as completed, and a type of error.

METHOD OF TESTING.

The Healy Frame Test in its completed form was passed quickly in front of the immigrant's gaze, in order to show him that all of the pieces fitted into the frame; but the exposure was so short that the position of the different pieces could not be memorized. The small pieces were next emptied on the examining table, the empty frame

was placed in front of the subject, the pieces were mixed, and the interpreter told the subject to place all the pieces within the frame so as to cover completely the area within the frame.

Time was taken with stop watch from the second the alien touched one of the small pieces. The false moves or the placing of pieces in faulty positions were recorded. A faulty position would be a position

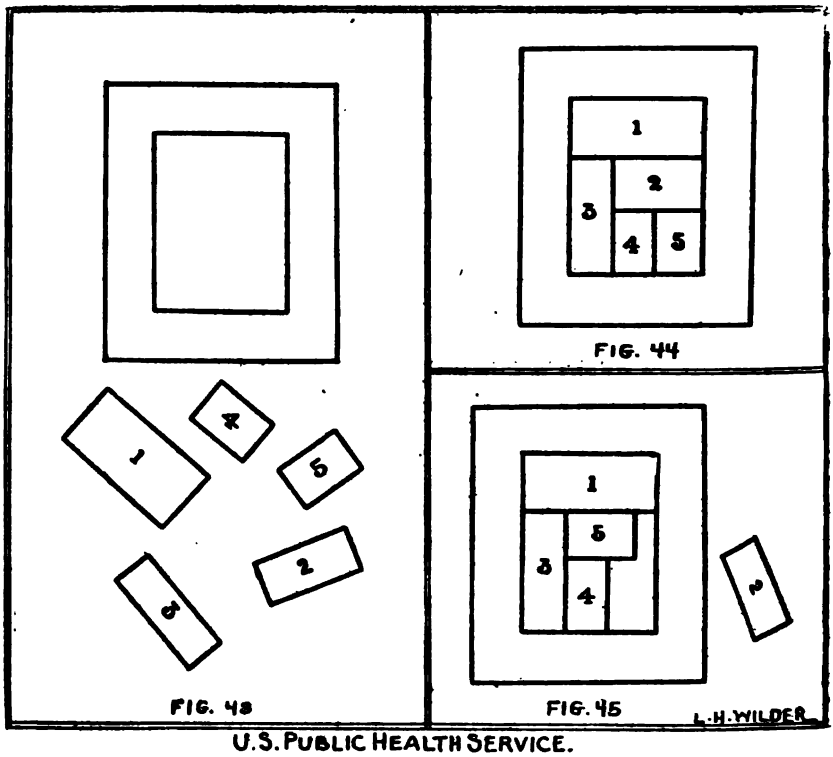


FIG. 43.—Healy Frame Test, as presented to immigrant for solution.

FIG. 44.—Healy Frame Test as solved.

FIG. 45.—A type of error in attempt to solve Healy Frame Test.

assumed by any piece which would prevent the solution of the test or which could be considered relatively false.[1] As in the Geographic Puzzle, if the test was not performed in 300 seconds, it was recorded as a failure and the immigrant was shown how to execute the test. A second trial was given each immigrant, whether or not he had succeeded at the first trial.

[1] See p. — for explanation of "relatively false."

RESULTS.

The results in certain groups are given below:

TABLE 37.—*Results of Healy Test in the case of literate 15 and above group.*

Men (51 examined).							Women (49 examined).						
Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
	Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.				Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.		
	245	14	105	5			1	Failed.	35	60	5		
	93	17	18	0			2	156	14	150	15		
	96	13	30	0			3	110	3	17	0		
	27	2	15	0			4	130	14	15	1		
	167	16	17	0			5	70	8	15	0		
	16	1	12	1			6	136	15	14	1		
	Failed.	[1] 30	38	3			7	Failed.	38	20	2		
	26	0	12	1		×	8	153	15	37	4		
	27	3	14	0			9	50	10	22	3		
	110	11	20	0			10	70	6	11	0		
	17	1	7	0			11	18	2	12	1		
	33	2	22	0			12	47	7	43	2		
	211	12	26	0			13	135	15	11	0		
	110	11	36	3			14	Failed.	28	266	20		
	41	6	16	1			15	9	0	10	0	×	
	28	0	11	0			16	Failed.	[1] 41	9	0		
	26	2	11	0			17	140	12	166	15	×	×
	40	3	14	0			18	Failed.	46	16	3		
	113	10	16	1			19	150	29	55	7		
	32	3	12	0			20	288	33	13	1		
	35	4	17	1			21	25	2	13	0		
	64	6	8	0			22	71	8	25	0		
	105	11	29	1			23	136	15	13	1		
	29	5	8	0			24	80	5	17	0		
	30	1	12	0			25	207	19	43	3		
	20	3	6	0			26	80	7	15	0		
	10	0	8	0			27	104	16	8	0		
	53	4	17	0			28	125	10	19	2		
	70	7	43	1			29	Failed.	26	15	1		
	50	6	27	1			30	37	4	62	2	×	
	Failed.	[1] 31	26	2			31	251	19	22	1		
	Failed.	[1] 35	13	1			32	11	0	19	2	×	×
	40	6	16	1			33	85	8	35	2		
	71	7	67	7			34	210	19	102	5		
	128	17	10	0			35	156	19	16	0		
	26	2	51	2	×		36	9	0	9	0		
	17	2	14	1			37	Failed.	[2] 27	15	0		
	149	13	15	0			38	27	2	14	1		
	78	10	12	0			39	62	10	33	2		
	36	5	22	4			40	60	8	12	0		
	16	0	14	0			41	82	8	86	9	×	×
	22	1	38	4			42	115	11	19	1		
	12	1	55	4	×	×	43	176	12	9	0		
	46	5	16	1	×	×	44	98	11	8	0		
	108	10	12	0			45	82	14	45	4		
	30	3	24	3			46	103	9	23	2		
	35	2	10	0			47	39	5	13	0		
	Failed.	[1] 26	105	8			48	100	16	11	0		
	55	4	25	1			49	61	6	17	0		
	38	1	22	1									
	56	4	32	4									

[1] Succeeded after 320 seconds.

[2] Succeeded after 316 seconds.

TABLE 38.—*Results of Healy Test in the case of Italian illiterate group.*

Men (20 examined).							Women (20 examined).						
Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
	Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.				Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.		
1	Failed.	26	60	20			1	108	10	9	0		
2	245	18	54	2			2	Failed.	14	59	2		
3	35	1	26	0			3	93	7	25	0		
4	13	1	11	0			4	110	6	17	0		
5	Failed.	26	32	2			5	78	8	28	4		
6	235	30	17	2			6	Failed.	24	95			
7	27	1	16	1			7	45	0	20	0		
8	41	4	Failed.	33			8	Failed.	23	20	2		
9	209	13	12	1			9	156	15	50	6		
10	24	3	10	0			10	42	8	19	0		
11	74	11	12	0			11	71	8	19	1		
12	121	7	17	0			12	130	18	13	0		
13	40	3	55	5	×	×	13	Failed.	35	Failed.			
14	27	4	9	0			14	50	6	21	2		
15	85	8	19	0			15	41	5	9	0		
16	Failed.	[1] 12	12	0			16	25	3	19	2		
17	58	8	9	1			17	55	7	64	5		
18	30	2	12	0			18	243	16	23	0		
19	14	1	17	0	×		19	195	10	26	0		
20	23	1	21	1			20	113	8	12	1		

[1] Succeeded after 316 seconds.

TABLE 39.—*Results of Healy Test in the case of Slav illiterate group.*

Men (10 examined).							Women (30 examined).						
Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.	Alien's number in group.	Trial No. 1.		Trial No. 2.		Aliens taking more time at second than at first trial.	Aliens making more false moves at second than at first trial.
	Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.				Number of seconds required.	Number of false movements made.	Number of seconds required.	Number of false movements made.		
1	40	5	16	0			1	24	1	10	0		
2	160	15	19	1			2	209	12	89	8		
3	30	2	15	1			3	Failed.	[2] 32	59	5		
4	36	3	15	0			4	83	11	13	0		
5	195	16	21	0			5	232	20	76	5		
6	184	18	14	0			6	30	3	25	0		
7	Failed.	37	26	2			7	109	12	20	1		
8	Failed.	[1] 24	14	1			8	221	27	12	0		
9	107	14	40	6			9	143	18	15	0		
10	18	2	97	8	×	×	10	Failed.	25	21	0		
							11	259	32	11	0		
							12	Failed.	22	45	2		
							13	Failed.	27	30	2		
							14	Failed.	[3] 27	17	0		
							15	98	11	50	4		
							16	210	25	124	11		
							17	53	8	60	13	^	^
							18	Failed.	25	12	0		
							19	70	7	24	2		
							20	41	2	18	0		
							21	19	1	14	0		
							22	104	9	150	12	↘	↘
							23	67	8	12	0		
							24	59	2	12	0		
							25	14	1	37	3	↗	↗
							26	55	7	13	0		
							27	26	3	14	1		
							28	9	0	9	0		
							29	109	9	15	1		
							30	25	3	9	0		

[1] Succeeded after 305 seconds. [2] Succeeded after 300+ seconds. [3] Succeeded after 330 seconds

SUMMARY OF RESULTS.

One hundred and forty-five out of 174 literate immigrants (83+ per cent) succeeded in solving this test within 300 seconds at the first trial. Seventy-five per cent of every group succeeded in doing this test at trial 1 with the exception of the girls of the *literate 12–14* group, only 58− per cent of their number succeeding. The time ranged in these successful cases from 9 seconds to 288 seconds. The average time for the performance at the first trial was 94 seconds. The shortest average time (75 seconds) was made by the 10 children of the *literate 9–11* group, the longest average time (112 seconds) by the 11 girls of the *literate 12–14* group. The men and boys of the *literate 15 and above* and *literate 12–14* groups made better average time than the women and girls of the same groups.

The average number of false moves at the first trial for all the literate groups combined were 10. The smallest average number of false moves at this trial (6) was made by the men of the *literate 15 and above* group. The largest average number of false moves 13 were made by the 14 boys of the *literate 12–14* group. There is little difference in the number of false moves as regards sex. It is interesting to note that the 10 children of the *literate 9–11* group averaged only 8 false moves.

At the second trial 144 out of 145 literate immigrants succeeded. One girl of the *literate 12–14* group failed. The time ranged in the successful cases from 7 seconds to 200 seconds. The average performance time at the second trial in 144 cases was 23 seconds. The shortest average time (15 seconds) was made by the 10 children of the *literate 9–11* group, the longest average time (31 seconds) was made by the women of the *literate 15 and above* group. At trial 2 the men of the *literate 15 and above* group made better average time than the women, and the girls of the *literate 12–14* group made better average time than the boys of the same group.

The average number of false moves at the second trial for the literate groups was 1⅓, the largest number (3) being made by the boys of the *literate 12–14* group, the smallest average number of false moves (⅔) being made by the 10 children of the *literate 9–11* group.

Ninety-seven out of 119 illiterate immigrants (81½ per cent) succeeded in solving the Healy Frame Test within 300 seconds at the first trial. Seventy-five per cent of every group succeeded in doing this test at trial 1 with the exception of the 8 women of the *illiterate 15 and above* group; only 5 of them, or 62½ per cent, succeeded. The time ranged in these successful cases from 9 seconds to 275 seconds. The average performance time for the first trial in all of these illiterate groups was 86 seconds. The shortest average time (54 seconds) was made by the 5 successful members of the group which made the

poorest record; namely, the women of the *illiterate 15 and above* group. The longest average time (99 seconds) was made by the *illiterate 10–11* group. The men and women of the *Slav illiterate* group made about the same average time, 96 seconds and 95 seconds respectively; while the men of the *Italian illiterate* group excelled the women, their respective times being 77 seconds and 97 seconds.

The average number of false moves for all the illiterate groups at the first trial was 8¼. The smallest average number of false moves 7) was made by the following groups: Men of the *Italian illiterate, illiterate 15 and above,* women of the *illiterate 15 and above* and children of the *illiterate 12–14* groups; the largest average number of false moves (11) was made by the *illiterate 10–11* group. As regards sex there is practically no difference in regard to the average number of false moves. It is interesting to note that a number of the illiterate groups made a smaller average number of false moves than the literate groups.

At the second trial 95 out of 97 illiterate immigrants succeeded. Two failures occurred, one in the *illiterate 12–14* group and the other was a man of the *Italian illiterate* group. The time ranged in these successful cases from 9 seconds to 239 seconds. The average performance time at the second trial in these 95 cases was 31 seconds, the shortest average time (16 seconds) was made by the 5 women of the *illiterate 15 and above* group, the longest average time (53 seconds) by the *illiterate 10–11* group. The men of the *Slav illiterate* and *Italian illiterate* groups made slightly better average time than the women.

The average number of false moves at the second trial for all the illiterate groups combined was less than 2, the largest average number of false moves (3) was made by the *illiterate 10–11* group, men of the *illiterate 15 and above* group, and women of the *Slav illiterate* groups, the smallest average number of false moves (⅘) was made by the 5 women of the *illiterate 15 and above* group.

CONCLUSIONS.

From the above, it may be concluded that:

(1) As 75 per cent of both literate and illiterate immigrants who were tested are able to solve the Healy Frame Test within 300 seconds, it is not too difficult a test at the time of landing for immigrants above the age of 9.

(2) At the first trial the illiterates performed the test a little more quickly and with a smaller number of false moves than did the literates. At the second trial the reverse was true.

(3) For practical purposes there is little difference between the literates and illiterates in the execution of this test.

(4) As in the case of the Geographic Puzzle, there is no marked difference in the performance of this test for different ages above the age of 9.

(5) For convenience, it may be remembered that, for both literates and illiterates at the first trial, the Healy Frame Test is performed in an average time of 90 seconds and with 9 false moves. At the second trial the performance time is only one-third to one-tenth of what it was at the first trial.

DISCUSSION.

It is important to mention that in the experimental examination which lasted about one and one-half hours for each immigrant, the Healy Frame Test was executed toward the close of the examination after the immigrant had been undergoing various tests for a period of from 70 to 75 minutes. At this period some subjects were more fatigued, some more discouraged, and others more enthusiastic than at the beginning of the examination.

At the beginning of the investigation it was presumed that the Healy Test would be a new problem for nearly all alike, that the small amount of formal schooling, one or two years, in the case of literates, would not bestow any material advantage on them in the execution of this test. It would now appear that this idea was correct. The percentage of successes in the two classes of immigrants was almost identical (83+ per cent literates; 81½ per cent illiterates).

The natural order of performance was in the majority of cases to first place piece 1 in its proper transverse position. This procedure fills a comparatively large space and simplifies the problem to an opening into which 4 pieces must be placed. Pieces 2 and 3 are next placed, sometimes piece 2 being placed first, but more often piece 3. Pieces 4 and 5 are usually the last pieces placed. These 5 small pieces can be arranged in 16 combinations, any one of which is correct.

In doing the Healy Test a piece may be rightly placed but its position may be relatively false and it is therefore counted as a false move. Thus, in Fig. 45 piece 4 is occupying a faulty position. Piece 5 is then placed in the lower left corner. Its position, while actually true, is relatively false as long as piece 4 remains where it is. In assuming this position a false move is credited to piece 5. When pieces 4 and 5 are so placed as to assume the position represented in Fig. — the subject may get a false sense of security and hold tenaciously to this false position.

The Healy Frame Test, like many other performance tests, shows the immigrant's ability in two directions, reasoning and learning. If he has never done the test before and does it quickly and with few false moves, or if he carefully observes the frame and the individual

pieces and with a few false moves slowly accomplishes the task, reasoning ability in some degree is suggested. However, he may fail to perform the test within the required 300 seconds and yet be a good reasoner. Some accidental circumstance, such as emotional disturbance and fatigue, prevent the successful execution of the test.

Should the immigrant become acquainted with this test before landing it would be of little value as a test in reasoning, for success would be simply a memory feat. A test in reasoning must be composed of new and unfamiliar elements as well as of old and familiar ones. After the immigrant has been shown how to solve the Healy Test, or after he has, over a considerable time, worked it out for himself, the manner of the performance and speed of performance at the second trial will throw some light on his learning ability.

At times, the second trial shows the accidental nature of the success at the first trial.[1] For instance, in the second trial, when piece 1 is placed longitudinally instead of transversely at the start. When this happens it usually means that the subject is facing the problem for the first time. His success at trial 1 was accomplished accidentally while his attention was directed to other affairs, internal or external. Such a movement at the second trial may also mean a defective reaction. Exceptionally, this test has been performed twice in succession by accident.

As in all other tests, any previous experience related in any way to this test will be of assistance to the subject in performing it. In this connection, during the investigation it seemed that carpenters and bricklayers, perhaps on account of their keenness of form perception, executed the test with comparative ease. One immigrant did poorly with the Opposites and other tests. When asked as to how he succeeded in doing the Healy so well, he replied through the interpreter, "I am a brickmaker and the arrangement of these pieces comes easy to me."

The test is considered well performed if done quickly at the second trial, even though a long time was required and many false moves made at the first trial. There should be no unusual delay in the doing of this test at the second trial. In general, when the Healy Frame Test has been mentally analyzed and performed, there should be no subsequent trouble in executing it. Occasionally, at the first trial the normal immigrant will give a smile of gratification as he analyzes, sees the point, and completes the test. In such cases the second trial is usually accomplished in from 10 to 15 seconds.

If the intelligent subject keeps in mind the abstract principle "Every space must be filled," he will succeed even though he have

[1] A psychologist visiting Ellis Island made an objection to this test, saying that if piece 1 accidentally fell into its right position at the start, the test would be so much easier to perform. This is probably a valid objection, but the same objection could be made to other tests.

comparatively poor vision. The execution of the test does not require the thorough searching of details required in the case of the Geographic and Relationship Tests. In fact, whenever an intelligent subject has a restricted visual field he will be able more easily to perform this test than either the Geographic or Relationship Tests.[1]

RELATIONSHIP.

The Relationship Test was suggested by Prof. R. S. Woodworth, of Columbia University. The testing material consists of 2 parts—the board and the field.

(1) The board is 18½ inches long and 5¾ inches wide. It contains 10 raised designs or pieces securely attached. Four of these designs, situated on the upper row, are similar in shape and color to 4 designs of the lower row. The only difference in the designs of the 2 rows is a difference in size.

Two other designs (a large black square situated on the upper row and a small red triangle on the lower row) are opposite vacant spaces. (Fig. 46.)

(2) The field, situated to the right of the board, contains 13 detached designs of odd color and shape. Among these pieces are 2 squares, 1 large and 1 small; and 2 red triangles, 1 large and 1 small.

METHOD OF TESTING.

The board and field were placed on the examining table in front of the immigrant. Pointing to the large and small pieces of the board the interpreter said:

These designs of the upper row are very much like the designs of the lower row. They are of the same color and shape. This circle is like that circle [pointing to them].

---

[1] The following is quoted from p. 15 of one of the psychological monographs "Tests for Practical Mental Classification" by William Healy, M. D., and Grace Maxwell Fernald, Ph. D.:

"This test brings out perception of relationships of form and also the individual's method of mental procedure for the given task—particularly his ability to profit by experience of repeated trials, in contradistinction to the peculiar repetition of impossibilities characteristic of the subnormal and feeble-minded groups. * * * It would seem apparent that for estimating mental ability the method pursued in this task is of much greater value than the actual time. Probably all would acknowledge that a trial method, where the subject proceeds intelligently from one apparent possibility to another, even though a relatively long time is consumed, will not necessarily indicate lack of native ability. * * *"

The following is quoted from p. 107 of "The Individual Delinquent" by William Healy, A. B.,[1] M. D. The quotation shows what Dr. Healy has to say about his own test. His observations, of course, have been made in an environment different from that of arriving aliens.

"*Test III. Construction Test A.*—This is one of our more important tests. * * * No normal person over 8 or 9 years should fail to do it in 5 minutes. At 12 years we find great variation in time, showing very distinct differences in ability. Some grasp and plan the task very readily, performing it in 12 seconds to 15 seconds; nearly all of those normal mentally getting it done in 2 minutes. To be considered as done well, it should be done within these limits, and without replacing pieces in obviously impossible positions. Of course a planned method is better than trial and error, but some get through rapidly by quickly perceiving the possibilities of the latter. The number of moves used depends, of course, on the method. Estimation of the method is certainly more important than the time, within the above limits. The least possible number of moves is five. The private-school group all succeeded from the second grade up with a gradual diminition of the average time, which in the second grade was 2 minutes 7 seconds; 33 per cent failed in the first grade, even with 10 minutes trial, and 23 per cent in the second grade. Beginning with fourth grade 50 per cent did it by planning. None in this school did any better than many of the best in the group of offenders."

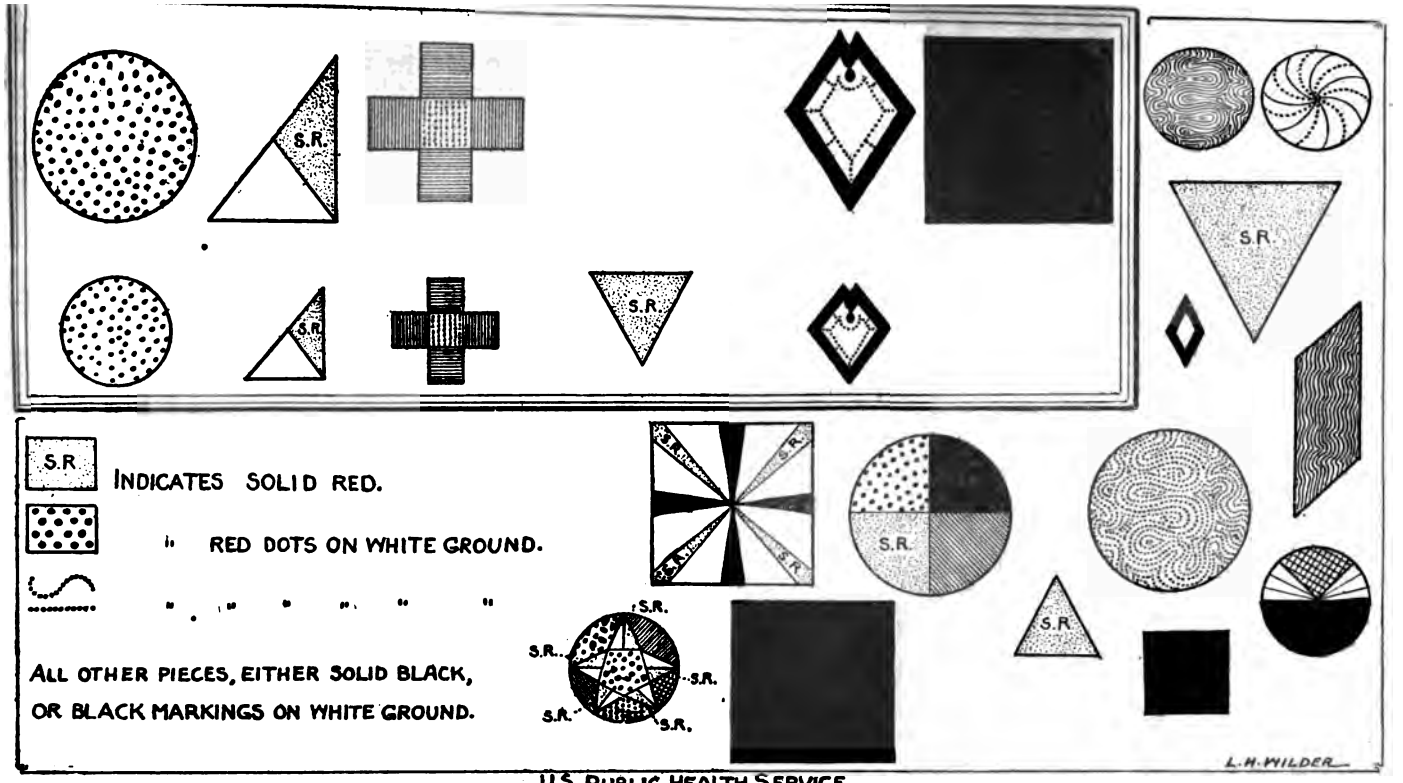


FIG. 46.—Arrangement of pieces in Relationship Test. The markings are only roughly indicative of the actual blocks used.

This triangle is like that triangle, this cross is like that cross, this diamond is like that diamond; but all the pieces of the upper row are large, all the pieces of the lower row are small. There are two vacant spaces on the board [pointing to them]. Find from the field [pointing to it] the two missing pieces and place them in their positions on the board.

There are three possible moves to be made at each vacant space:

(1) The placing of an obviously wrong piece, which was scored 0.

(2) The placing of a piece exactly like the piece in the opposite row (same color, shape, and size). As a movement of this kind shows some thinking, a score of ½ point was given.

(3) The placing of the proper piece. This piece will be the same in color and shape, but different in size to the piece of the opposite row. The placing of the correct piece scored 1 point. The perfect score for both vacant spaces was therefore 2.

After the instruction had been given the immigrant was allowed a minute in which to fill the vacant spaces and make any correction he wished in his movements.

RESULTS.

The results of this test were as follows:

TABLE 40.—*Results of Relationship Tests.*

Group.	Number examined.	Number of aliens scoring one or more points.[1]			Percentage.	Number of aliens scoring less than one point.		Percentage.
		2 points.	1½ points.	1 point.		½ point.	0 points.	
Literates:								
9–11	12	6	4	2	100	.....	.....	.....
Hebrew, 9–11	25	9	9	6	96	.....	1	4
12–14—								
Boys	18	6	4	6	89 −	1	1	11 +
Girls	19	10	6	2	94½+	1	.....	5½−
15-above—								
Men	51	19	11	16	90 +	.....	5	10 −
Women	49	26	8	9	87½+	.....	6	12½−
Illiterates:								
10–11	4	.....	.....	4	100	.....	.....	.....
12–14	8	1	1	4	75	1	1	25
15-above—								
Men	19	4	6	7	86½	.....	2	13½
Women	8	2	3	1	75	1	1	25
Italian—								
Men	19	4	5	4	68½+	1	5	31½−
Women	20	3	2	6	55	2	7	45
Slav—								
Men	10	2	2	5	90	.....	1	10
Women	30	8	8	12	93½	1	1	6⅔

[1] One point was given for correctly placing each of the two pieces in the vacant spaces. One-half point was scored for placing a piece exactly like the one in the opposite row (of the same size).

Seventy-five per cent of all literate groups succeeded in scoring at least 1 point. Seventy-five per cent of all the illiterate groups succeeded in scoring 1 point with the exception of the *Italian illiterate* group. Only 68½ per cent of the men and 55 per cent of the women of this group succeeded in scoring 1 point. The comparatively poor

showing of this group is perhaps the most interesting feature in the result.

It will be noticed that the young subjects of both literate and illiterate groups did as well if not better than many older subjects.

DISCUSSION.

This is essentially an elementary test in problem solving or reasoning involving the relationship of color, size, and form perceptions. The sagacious subject in doing the test surveys the board, observing its component parts and their relationships. Likewise, he will survey the field and by a process of his selective judgment will complete the test.[1]

Good vision is necessary for the performance of this test.

MODIFICATION.

The Modification Test is a modified form of the Geometrical Figure Test used by A. R. Abelson and was suggested for trial among arriving immigrants by Prof. Henry Alfred Ruger, Department of Psychology, Teachers College, New York City.

The Geometrical Figure Test consists of a series of designs containing circles, squares, and triangles interlocking one another in various ways. Some of the figure arrangements are simple, others complicated. The test consists in getting the subject to point to a spot on a certain design that would be included within so many circles, so many triangles, and so many squares.

The immigrants, both literates and illiterates, experimented upon in this examination are unfamiliar with these geometrical forms and before such a test could be attempted with them a thorough explanation of these figures would have to be made. As such a procedure would cause delay, it was thought that a simplified form of the same test could be used, only substituting familiar animals for the geometrical figures. Hence the modified test as presented to the immigrants in this experiment consisted of 4 designs containing the outline drawings of 2 chickens, 2 pigs, and a man arranged in different interlocking combinations. The combinations used were as follows:

1. Pig and chicken. (Fig. 47.)
2. Pig, chicken, and man. (Fig. 48.)
3. Two pigs, chicken, and man. (Fig. 49.)
4. Two pigs, 2 chickens, and man. (Fig. 50.)

[1] Surgeon T. Clark of the Public Health Service after seeing this test performed a number of times suggested that instead of having the board composed of attached pieces, that every piece be a detached piece and that it be fastened to its position on the board by a screw or a glove-button device.

This would enable the examiner to set up a number of new problems. In this event, coaching a stupid immigrant on any particular problem before the examination would have little influence on the result.

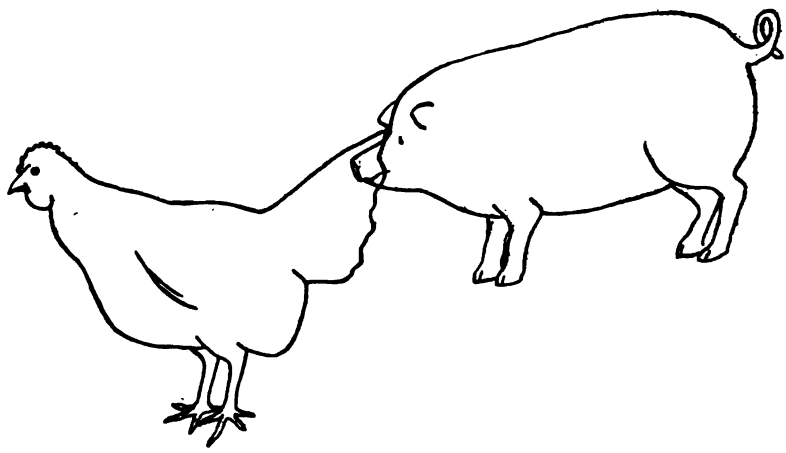


FIG. 47.—Pig and chicken. Modification Test. (Reproduction is one-fourth the size of the original.)

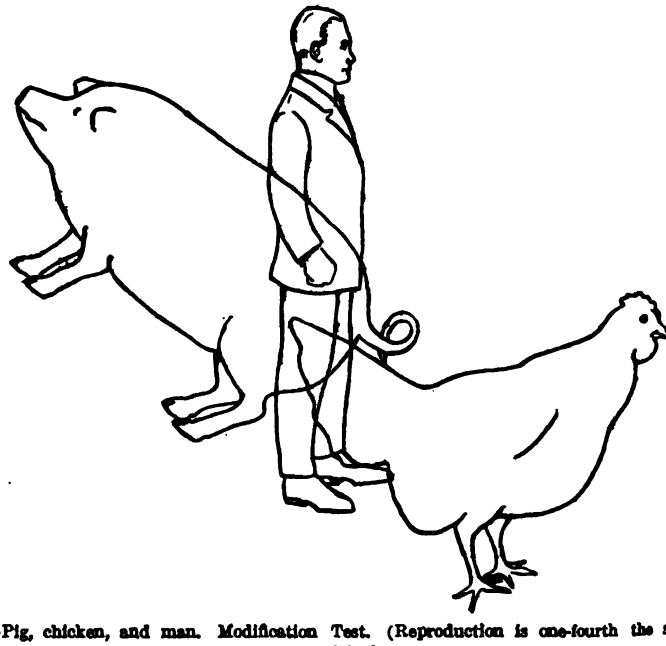
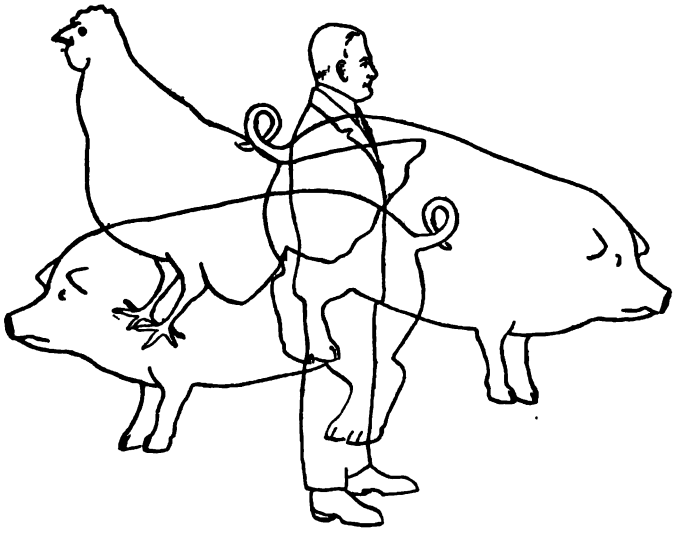


FIG. 48.—Pig, chicken, and man. Modification Test. (Reproduction is one-fourth the size of the original.)



IG. 49.—Two pigs, chicken, and man. Modification Test. (Reproduction is one-fourth the size of the original.)

. 50.—Two pigs, two chickens, and man. Modification Test. (Reproduction is one-fourth the size of the original.)

METHOD OF TESTING.

The design containing the pig and chicken (fig. 47) was placed on the examining table in front of the subject. The interpreter first asked the immigrant if he recognized the drawings. Practically all answered in the affirmative. A pointer was then placed in the immigrant's hand and the interpreter said to him:

Touch with pointer only the chicken. [Pause for execution.]
Touch only the pig. [Pause for execution.]
Now touch both chicken and pig at the same place.

At the termination of this explanation, if the subject did not comprehend what was wanted of him, a second and similar explanation was gone through with.

The design containing the pig, chicken, and man (fig. 48) was then placed in front of the subject, and the interpreter said to him:

Touch only the pig. [Pause for execution.]
Touch only the chicken. [Pause.]
Touch only the man. [Pause.]
Now touch all 3—pig, chicken, and man—at the same place.

This test was almost invariably accomplished. Then the designs containing 4 and 5 animals were placed in front of him, and a similar instruction was gone through with in solving each design.

RESULTS.

The results of the tests are given below:

TABLE 41.—*Results of Modification Test.*

Group.	Number examined.	Aliens successful with designs containing at least 4 figures.[1]			Aliens successful with designs containing less than 4 figures.	
		Designs with 5 figures.	Designs with 4 figures.	Percentage.	Designs with 3 figures.	Designs with 2 figures.
Literates:						
9–11	12	2	7	75	3	.....
Hebrew, 9–11	25	3	18	84	3	1
12–14—						
Boys	18	5	10	83⅓	3	.....
Girls	19	5	14	100	.....	.....
15–above—						
Men	51	17	31	94 +	3	.....
Women	49	15	28	87½+	5	1
Illiterates:						
10–11	4	1	2	75	1	.....
12–14	8	2	6	100	.....	.....
15–above—						
Men	21	4	15	90½	1	1
Women	8	1	5	75	1	.....
Italian—						
Men	20	4	14	90	2	.....
Women	20	2	15	85	2	1
Slav—						
Men	10	3	6	90	1	.....
Women	30	4	22	86⅔	4	.....

[1] It is to be understood that aliens succeeding with a certain design have also been successful with each of the simpler designs.

Seventy-five per cent of every group were successful with designs containing at least 4 animals. The men, both literate and illiterate, made a better showing than the women. The girls of the *literate 12–14* group were the only exception, as they excelled the boys of the same group. The Italian and Slav groups seem to be on a par in the performance of this test. No difference exists in the solution of this test as regards age, the 10 and 11 year old children seeming to do as well as the adults. For practical purposes it may be concluded that:

Normal immigrants above the age of 9, regardless of age, nationality, and literacy, can succeed with designs containing 4 animals.

DISCUSSION.

The classification of certain tests depends in a degree upon the kind of subjects that are tested. A simple test that almost reflexly brings out perception and discrimination in a highly educated and experienced person may be classified as a real test in reasoning when it is used on an inexperienced and illiterate person. The Modification Test is an entirely new and complex presentation to the majority of immigrants, and it is therefore best to classify it among the problems or reasoning tests. Few immigrants of the peasant type have had experiences which would assist them in the performance of this test. Furthermore, the results show that the record of performance is about as good in the case of the illiterates as in that of the literates.

In view of these facts it might be well to claim that this test is one of the best tests of the entire investigation for bringing forth native ability.

The Modification Test brings about that form of purposive thinking wherein a selection which fulfills certain conditions must be made. To fulfill the conditions in this test, the subject must have a perception of the individual animal. The outlines of each animal must be isolated and visually traced until it is plainly seen that such outline surrounds the proposed point of contact. When all the animals of a design have been thus considered, the hypothetical point of contact becomes the real point and the problem is solved.

The calm and thinking subject, in solving the design containing five animals, will look slowly to the right and left, occasionally turning the design from side to side. After mentally tracing and searching over a period of from 5 to 30 seconds, he will place the pointer on the right area. In other words, a considerable delay, moving of the eyes from side to side, as attention to separate details takes place, and a correct plunge with the pointer, would indicate that the subject is employing the "thinking method."

If the subject plunged the pointer quickly, especially in the case of the last design, and struck the right area, another trial was im-

mediately given him in order to see if his success at first were accidental.

The method of administering this test—that is, getting the subject to point out each animal before pointing to the central contact area—is really a number of subsidiary tests, each involving an analytic process.

Other tests similar to the Modification Test may be employed in the mental examination of immigrants. Designs containing other animals or other objects could be arranged similarly to the animals here presented, the idea being to have a series of new problems to present to the immigrant at successive examinations, in order that light may be thrown on his reasoning and learning ability.[1]

DEFINITIONS.

The definitions of two common nouns, a verb, and an abstract noun were required of each immigrant. The words selected were: Tree, bed, run, and truth.

METHOD OF TESTING.

The interpreter said to the subject, "What is a tree?" The literal translation of the immigrant's response was quickly written down on his chart. Then the other definitions were taken up in the same way.

The replies given by immigrants were so unsatisfactory that it was hypothecated early in the experiment that ability to define was dependent to a large extent upon definite training. In order to test the truth or falsity of this hypothesis a number of immigrants were given the definition of a chair,[2] after which they were asked to define a table in order to see if there occurred any improvement in defining ability.

RESULTS.

The definitions here presented are selected from members of the *literate 9-11*, *Hebrew literate 9-11*, and *Slav illiterate* groups. The definitions of a table as well as of the four original words are given.

LITERATE 9–11 GROUP.

Italian (male, age 9, 3 years of schooling).

Tree: A plant.
Bed: It is an article; it serves for people to lie upon.
Run: A child that is going through the streets runs.
Truth: (No reply.)

Table: To eat on, to write on, to iron clothes on.

---

[1] Clark, of the Public Health Service, suggests that the contact point on the different designs be variously placed. This suggestion, while making the execution a little more difficult, rules out the accidental plan and if carried out, will undoubtedly enhance the value of the test.

[2] The following definition was used, the interpreter making a distinct pause between the different parts of the definition:

"A chair is a piece of furniture—It is made of wood, iron, or other materials—It may or may not have legs—It is used by people to sit on—For the purpose of working or resting."

Italian (male, age 10, 2 years of schooling).

Tree: A wood, there are leaves, there is fruit on it.
Bed: On which we go to rest.
Run: One is to run.
Truth: To tell the truth is right, but not tell a lie.

Table: To eat on, to write on, to stand things on, to put the lamp on, and sometimes to lay the baby on.

Italian (male, age 10, 1 year of schooling).

Tree: It makes fruit.
Bed: That in which we sleep.
Run: To do a thing and to do that in quick time.
Truth: Not to tell wrong things.

Table: Has 4 legs, is made of wood, which we eat on.

Italian (male, age 11, 3 years of schooling).

Tree: Make fruit.
Bed: Where you lay down at night.
Run: A child runs.
Truth: To tell the truth, not to tell lies.

Table: Is made to write on, to receive visitors, to beautify, for studying, for writing letters, to put the table cloth on, to put the eatables on, then to eat, then you take the things off, and you wash the dishes.

Russian Pole (male, age 11, 1½ years of schooling).

Tree: Woods.
Bed: Bedding.
Run: To trot.
Truth: To say something right.

Table: Is a furniture, it is to put things on.

Russian (male, age 9, 9 months of schooling).

Tree: It's a plant.
Bed: Where one has to sleep on it.
Run: To run with one's legs.
Truth: If one said the truth, just what he had done.

Table: Is a furniture, used to work on.

HEBREW LITERATE 9–11 GROUP.

Russian Hebrew (male, age 9, 5½ years at Cheydar).

Tree: Wood.
Bed: People sleep in it.
Run: To walk fast.
Truth: If you tell something and you don't want to believe it unless it is true.

Table: A furniture, one does something on the table, it is made of iron or wood, may be with legs or without legs.

Russian Hebrew (male, age 9, 4 years at Cheydar).

Tree: That grows apples and other fruits.
Bed: To sleep on.
Run: To work.
Truth: To tell a true thing.

Table: On a table you eat, write, study, work on it, I do not know how it is made.

Russian Hebrew (male, age 9, 2 years at Cheydar).

Tree: Grows.
Bed: Sleep in.
Run: If you get in a place where they are fighting you run away.
Truth: Not to tell a lie.

Table: Is to eat on, put things on, it is furniture.

Russian Hebrew (male, age 10, 5 years at Cheydar).

Tree: Wood.
Bed: Either wood, iron, or nickel.
Run: Move legs fast.
Truth: Not a lie.

Table: Is an object, on table they put down things, and eat and write, there are tables of one leg, it is of wood.

Russian Hebrew (male, age 10, 3 years at Cheydar).

Tree: Get fruit from it, and wood from it.
Bed: We sleep on it.
Run: To chase.
Truth: To tell the truth.

Table: Made of wood, it is to eat on, drink on or work on.

Austrian Hebrew (male, age 10, 2½ years of schooling).

Tree: It is apples.
Bed: To sleep on.
Run: Walk fast.
Truth: Correct.

Table: It is to write on, to eat on, to put things on, it is made of wood, iron, or other things, it is made with or without legs.

Russian Hebrew (male, age 10, 2 years at Cheydar).

Tree: It has roots and grows to fruit.
Bed: We sleep in it.
Run: To walk fast.
Truth: To tell a right thing, not to tell a lie.

Table: Is a furniture. On the table we eat, write.

Austrian Hebrew (female, age 10, 3 years of schooling).

Tree: It grows.
Bed: To sleep in.
Run: Walk fast.
Truth: Not to tell a lie.

Table: Is used for doing things that one had to do at a table, it is wood, has legs.

Russian Hebrew (female, age 10, ½ year of schooling in addition to 2 years at Cheydar).

Tree: It grows.
Bed: To sleep in.
Run: To go faster.
Truth: One does not tell a lie, that's the truth.

Table: It is a furniture, one works on it, writes on it.

Russian Hebrew (female, age 10, 2 years at Cheydar).

Tree: It grows fruit.
Bed: To sleep in.
Run: Run with one's legs.
Truth: Not to tell a lie.

Table: Is a furniture, to iron on, to eat on, to put things on.

Russian Hebrew (female, age 10, ½ year at Cheydar).

Tree: It is wood.
Bed: To sleep on.
Run: If one needs something quick.
Truth: If you say something, you have to say the truth; a true word is the truth.

Table: Is a furniture, if one wants to eat, write or work he does it on the table, they put things on it. Make tables with or without legs, it is made out of wood, iron or other things.

Russian Hebrew (male, age 11, 6 years at Cheydar).

Tree: Which is growing.
Bed: People sleep on.
Run: Run fast, walk fast.
Truth: True.

Table: Has four legs, Can not be without legs, don't make tables out of iron, table is to eat on, to write on, to put things on.

Russian Hebrew (male, age 11, 6 years at Cheydar).

Tree: On a tree all kinds of fruit are growing.
Bed: Is to sleep on.
Run: When needs something in a hurry; he walks fast, runs.
Truth: If I tell you something you think it a lie, you ask some one else, and if they say no, you know I didn't say the truth.

Table: To write on, to iron things on, to work, to eat on, to put bread on.

Russian Hebrew (female, age 11, 1 year at Cheydar).

Tree: It grows fruit or something else.
Bed: To sleep in.
Run: One walks fast.
Truth: When one says the truth not a lie.

Table: A furniture, of wood, iron, or other things; on the table they write or do other things, put things on, has legs or no legs.

SLAV ILLITERATE GROUP.

Russian (male, age 16, 3½ months' schooling).

Tree: Something growing.
Bed: Object on which we sleep.
Run: Walking, then break out in a run.
Truth: Is true to tell the truth.

Table: Is to eat on, to write on.

Russian (male, age 18, 3 months' schooling).

Tree: Is a plant.
Bed: Cot to sleep on.
Run: To catch something as to run after.
Truth: If I see something and am asked about it, and say just what I have seen.

Table: Is a furniture; people are eating or writing on it. It may have one or four legs; it is also made of iron.

Russian (male, age 18, 5 months' schooling).

Tree: Pear tree, oak, birch, maple, linden.
Bed: What you sleep in.
Run: To get quicker to a place.
Truth: Whoever tells the truth.

Table: Has legs; we eat at the table coming home from work; they write on it, put things on it, and clean the table.

Russian Pole (male, age 20, no schooling).

Tree: To saw down and put houses from.
Bed: To lie down.
Run: To walk.
Truth: Not to lie.

Table: To eat on; to sit around; to read and write on.

Russian Ruthenian (male, age 22, no schooling).

Tree: Apple tree or an oak or cherry tree.
Bed: Quilt.
Run: A hare is running.
Truth: To tell the truth.

Table: To eat on; to write on; to do things on.

Austrian Ruthenian (male, age 24, no schooling).

Tree: What kind of tree?
Bed: To sleep on.
Run: To run away.
Truth: If one tell truth it is truth.

Table: Is to eat on.

Russian Pole (male, age 28, 5 months' schooling).

Tree: Is a plant.
Bed: A thing necessary for the people.
Run: To move away from the original place.
Truth: Correctness of the thing done.

Table: Is of wood; may be with or without legs; it is used for eating or to write on.

Austrian Ruthenian (female, age 16, 4 months' schooling.)

Tree: Apple tree, pear tree, plum tree, or willow.
Bed: To sleep on.
Run: That is the legs.
Truth: When you talk to one another you tell the truth.

Table: Is a furniture, covered with clothes; they sit at the table to eat, read, or write; it has drawers for books or other things.

Russian (female, age 17, no schooling).

Tree: Garden.
Bed: Cot to sleep on.
Run: To eat; I don't know; to walk.
Truth: Not to say a lie.

Table: Is made of wood, straw, or other material, with or without legs. At the table they sit down to eat or to work, to rest or to sew.

Russian Pole (female, age 18, no schooling).

Tree: A fir.
Bed: A cot.
Run: If you drive a horse he will run.
Truth: Who tells the truth not a lie.

Table: To put things on, to sew on.

Russian (female, age 18, no schooling).

Tree: To make house from, it grows.
Bed: To sleep on.
Run: To run to do it quicker.

Table: On the table we eat, write, and do other work; table stands; it is a furniture.

Austrian Ruthenian (female, age 18, no schooling).

Tree: That would depend upon what tree; I would give the name of a particular tree.
Bed: On which people sleep.
Run: To trot fast.
Truth: If you ask whether it is true, it is true if it is true.

Table: At a table people are sitting, putting dishes on and eating, it has legs and is made of wood and iron.

Russian (female, age 19, no schooling).

Tree: Material from which they make houses.
Bed: On which we sleep.
Run: Quicker than to walk.
Truth: Man lives right.

Table: On the table we eat and write.

Russian (female, age 20, no schooling).

Tree: Is a tree, woods.
Bed: Is a bed to sleep on.
Run: To run fast.
Truth: Is the truth.

Table: Is used to eat on; it is of wood or other things.

Austrian Ruthenian (female, age 20, no schooling).

Tree: To make things from.
Bed: To sleep on.
Run: To fly quickly.
Truth: When you tell something to some one; that is the truth.

Table: To eat on, to receive company around, and is made by a cabinet maker.

Austrian Pole (female, age 21, no schooling).

Tree: Would depend what tree.
Bed: To sleep in.
Run: To hurry.
Truth: Is that you must not lie.

Table: Is for writing, eating, and for other use. It has legs and is made of wood

Austrian Ruthenian (female, age 21, no schooling).

Tree: An ash tree, oak tree.
Bed: To sleep on.
Run: All sorts of things are running.
Truth: To tell the truth.

Table: Is to write on, eat on. It may have drawers, it is of wood, it has legs.

Austrian Ruthenian (female, age 23, no schooling).

Tree: Is an oak or a linden or an aspen.
Bed: To sleep on.
Run: One is in a hurry to run.
Truth: Is the best in the world.

Table: Is to eat on, made of wood or iron, they sit down at table to eat or receive visitors.

Russian (female, age 26, no schooling).

Tree: A tree used for building.
Bed: On which people sleep.
Run: When a man walks fast.
Truth: If a man acts righteous.

Table: Always has legs, people sit at it to read and write; it is made of wood or something else.

Russian Ruthenian (female, age 32, no schooling).

Tree: Depends; fruit tree, shade tree.
Bed: The blankets in which we sleep.
Run: To walk is slow; to run is fast.
Truth: Which is true.

Table: Is used for meals or for writing, play cards at the table or use it for other purpose, work on the table, to iron, cut clothes on.

Austrian Ruthenian (female, age 20, no schooling).

Tree: Birch aspen.
Bed: Of wood.
Run: If you run home in a hurry.
Truth: To tell the truth.

Table: Is to eat on and to write on.

DISCUSSION.

Immigrants defined some words better than others. They had less difficulty in defining "bed" than in defining the other words. "Run" and "truth" were as a rule poorly defined. "Bed" and "tree" in many instances were defined in terms of use.

The small amount of schooling which literate immigrants had eceived was of little assistance to them when it came to rendering lefinitions.

Much may be learned about immigrant psychology by a careful tudy of the above definitions. Many which are poorly expressed, o far as language is concerned, and appear to be worthless at first ight will upon further observation be found to contain one or more ssential ideas. Hence in studying an immigrant's definition the exminer should strive to pick out the idea or ideas which the definition ontains. Thus, when the immigrant defines "run" by saying "with gs" he means movement of the legs. On account of a lack of formal raining, he can not express himself.

When as a definition of "run" he says, "All sorts of things are nning" his idea most likely is that the capacity for running is ommon to many animals. When he says a tree "is an oak or a nden or an aspen" his idea is that trees are divided into many family roups.

Again when an immigrant says a tree "is a seed that sprouts into tree" his definition embodies three ideas; namely, that the tree arts from a seed, that it grows, and that it blooms into a full-grown lair. This definition simply lacks skill in expression.

Careful study of an immigrant's reply will show that his definitions, stead of being abstract, in many cases embody his own personal periences.

The real difficulty is the lack of language ability and inexperience the defining task, both of which are remediable by formal training. is a hard matter to gauge an immigrant's concepts at the time of nding by these definitions. It is likely that the immigrant possesses any ideas in regard to these and other words and in attempting to fine he only gives up a part of his information in regard to a given ord.

After the word "chair" was defined for the immigrants, it was nd that practically all showed improvement in defining the ord "table," most of them defining by use and in a more comehensive manner. The greatest improvement in defining after aining occurred among the Hebrew children.

Simply going to school will not enable an immigrant to define. order to perform this task attention must be given to concept velopment and the expression of ideas by means of language. In nclusion it may be said that above the age of 9 literate as well illiterate immigrants at the time of arrival give very unsatisfacy definitions. However, many immigrants are able to define mmon nouns principally in terms of use.

DESCRIPTION.

The Description Test consisted in presenting 5 pictures to the immigrant and getting him to describe what each picture represented. No preconceived notion as to what the immigrant knew concerning pictures was entertained by the examiner.

METHOD OF TESTING.

The 5 pictures—City, Butcher Shop, Barnyard, Harbor Scene, and Last Honors to Bunny (Fig. 51)—were presented to the subject one after another, permitting an observation of about 20 seconds in each case. The subject was then asked "Of what is this a picture?" His reply in the case of each picture was jotted down on his examination blank; but data are given in this bulletin only for the final picture (Last Honors to Bunny). In the case of this picture the following additional questions were asked, questions 2–6 being asked to find out at what question the main theme of the picture would be brought out:

2. What is going on in the picture?
3. What are the boys and girl doing?
4. What is the big boy doing?
5. Why is he digging a hole?
6. Is he digging a hole in which to bury the rabbit?
7. What is the girl going to do with the flowers?

RESULTS.

The replies of the 40 members of the *Italian illiterate* group to the first question ("Of what is this a picture?") are considered below. Five immigrants of this group gave a collective idea in their replies, 3 mentioning "country scene," 1 "woods," and 1 "New York." The replies of 9 indicated that the subjects saw some action in the picture. These replies were as follows:

(1) Girl, boy with shovel, boy crying, boy with flowers, cat, trees.

(2) Where the sheep are grazing.

(3) Three children that are promenading, one with flowers, one with shovel. While playing they find the dead rabbit. The sheep are grazing, the other child is displeased and is crying.

(4) Sheep grazing, cat.

(5) Children are playing with flowers and are watching the sheep.

(6) Boy is working with shovel, sheep are near, another one with hands to her face, a cat.

(7) Boy is hunting a rabbit, sheep, little girl, boy, hat.

(8) Children, child with flowers, boy that is digging, sheep, rabbit, plant, trees.

(9) He is working, girl has flowers, one is watching animal.

In reply to the same question (No. 1), 26 immigrants of this group simply enumerated details, some of the replies being as follows:

(1) Rabbit, 3 children, boy, private property, hat on ground, bunch of flowers, boy has a shovel in his hand.

(2) Three children, sheep, hat, this is a cat, I believe, trees around.
(3) Sheep, rabbit, children, taller boy has a shovel, hat.
(4) One little girl, 2 boys, 2 sheep, 1 lamb, a dead rabbit, a straw hat.
(5) Three children, sheep, hat, pig, trees.
(6) Children in field.

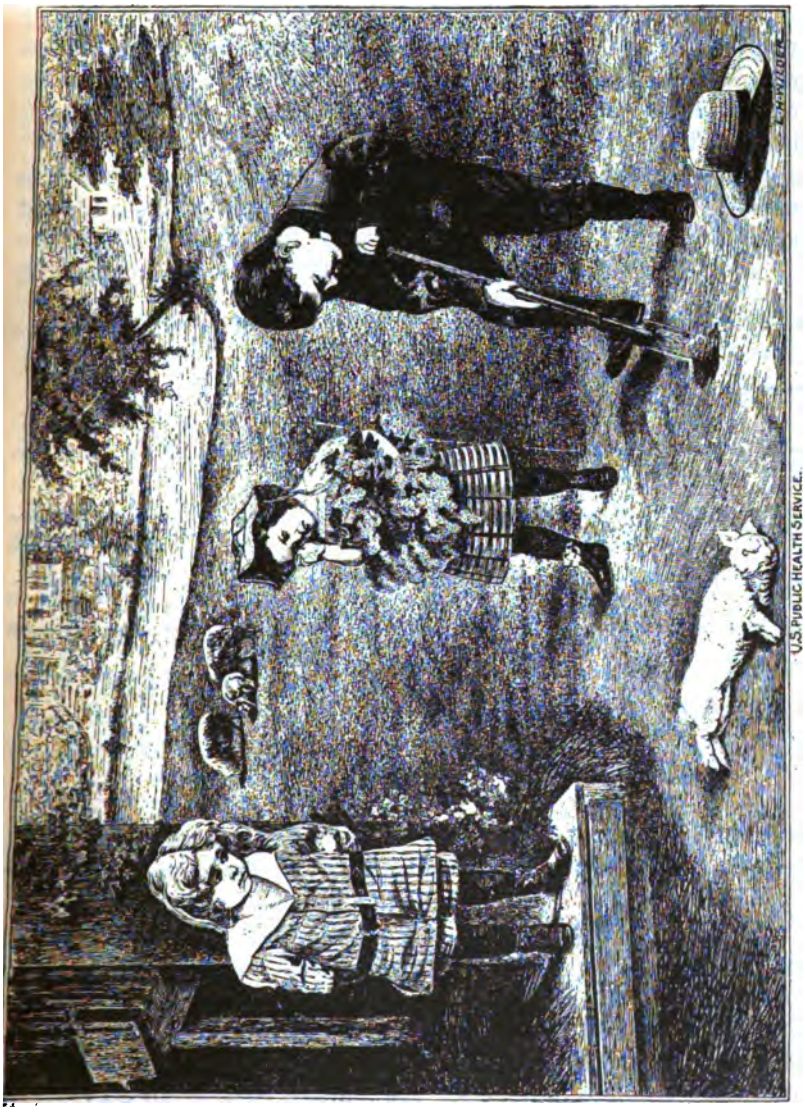


FIG. 51.—"Last Honors to Bunny" (taken from illustration used in Description Test).

(7) Children with spade, hat, child with basket of lemons, sheep, boy, rabbit, es.
(8) This is a child, this is a child, a rabbit, a hat.
(9) Boy, another boy and girl, sheep, trees, house, hat, shovel.
(10) Two children, hat, this animal (pointing to rabbit) I don't know what it is, ep, trees.

(11) Hat, man, child with handkerchief, flowers in other hand, little calf, a man.
(12) Three sheep, child
(13) Hat, little pig, sheep, children, child with flowers, stones.
(14) Three children, trees, a rabbit dead, boy has a shovel in his hand, trees.
(15) Two children, 1 boy, rabbit, hat, 2 sheep, lamb, trees.
(16) Children, 3 sheep, hat on ground, lamb on ground, hat.
(17) Man, girl, man, animal.

In response to this question 29 out of the 40 members of the *Italian illiterate* group pointed out the little white animal (rabbit) that lay on the ground and called it by the following names: Rabbit, 14; cat, 6; animal, 3; lamb, 2; pig, 2; calf, 1; rat, 1.

The complete responses to the first 6 questions will be shown in the case of 4 Italians of the same group. The first 2 (Nos. 15 and 73) failed to see the main point of the picture and the last two (Nos. 7 and 76) succeeded in interpreting the picture at question 5.

TABLE 42.—*Responses of 4 illiterate Italians to first 6 questions of Description Test.*

Questions.	No. 15, female, 31 years old.	No. 73, female, 39 years old.	No. 7, male, 29 years old.	No. 76, male, 27 years old.
(1) Of what is this a picture?	New York.....	Boy is hunting a rabbit. Little girl, boy, hat, sheep.	A country scene...	Sheep grazing, cat.
(2) What is going on in the picture?	Can I know what they are doing there?	It seems a private estate.	Three sheep.....	Dead cat is on the ground. Sheep grazing, stream passing.
(3) What are the boys and girl doing?	One is crying, one is shoveling, one is looking on.	Gathering flowers.	Playing.....	Children are bathing their feet in the water.
(4) What is the big boy doing?	Digging.....	He is hunting, he has a shovel and is playing.	Digging the ground with shovel.	He is playing with shovel.
(5) Why is he digging a hole?	How can I know?	Child's play.....	Maybe to bury the rabbit.	He wants to bury the cat.
(6) Is he digging a hole in which to bury the rabbit?	I don't know whether he will bury the rabbit or whether he is playing.	It may be if they do not eat it.		

The table below shows at what question in the picture the main point or theme of the story was brought out by the members of the *Italian illiterate* group. Nine immigrants failed to see the point altogether; 17 did not see the point until question 6 was reached; 9 did not see the point until question 5 was reached; 2 saw the point at question 3; and 3 saw it at question 2.

The last column of the table shows the response to question 7 (What is the girl going to do with the flowers?) In responding to this question 12 immigrants gave the "grave idea"; 10 gave the "home idea"—that is, to carry the flowers to mother or to the home—2 gave the "church idea"—that is, decorating the church—while 16 replies may be classed as miscellaneous.

TABLE 43.—*Question at which the point to picture (Last Honors to Bunny) was seen by members of Italian illiterate group and answers given by them to seventh question.*

At what question is the point seen?	What is the girl going to do with the flowers? (Question No. 7.)
Men:	
6	She wants to beautify something.
2	She wishes to adorn the house.
Point missed	I suppose she will present them to her mother.
Do	
6	She wants to take them to church.
6	To beautify some place.
6	Maybe she will give them to her brother.
6	To put on rabbit's grave.
6	Put into the grave.
2	She wants to adorn the rabbit's grave.
Point missed	How do I know.
3	She wants to decorate the grave.
5	She wants to adorn the grave.
5	Make an ornament for home.
Point missed	She will beautify the house.
Do	She is amusing herself.
5	I believe to decorate the rabbit's grave.
6	To bury them with the rabbit.
6	Take them to her parents.
5	Taking them home to her mother.
Women:	
5	She wants to amuse herself.
6	She wishes to cover the grave.
6	She wants to put them on table.
5	To put them on the rabbit.
5	She wants to put them on the animal's grave.
6	She is playing, too.
6	Perhaps take them home.
6	May decorate a little church with the flowers.
6	Bouquet.
6	Keep them for their perfume.
6	I don't know.
2	May want to put them on animal's grave.
Point missed	She wants to plant them.
5	Wants to carry them to church.
5	Take them with her to decorate.
Point missed	It seems she is crying and is disheartened.
Do	Wants to take them to her mother.
3	She wants to decorate the grave.
Point missed	How do you expect me to know.
6	To play.

Responses by some members of the *Italian* and *Slav illiterate* groups to certain questions[1] are given below. They will throw light on the small amount of general information and meager picture experience of immigrants.

TABLE 44.—*Replies by some members of Italian and Slav illiterate groups to certain questions as to Last Honors to Bunny picture.*

Nationality.	No.	Sex.	Age.	Question.	Answers.
Italian		M.	18	Have you seen pictures before?	I have seen only a few pictures. They were the pictures of saints.
Do	7	M.	29	Have you seen pictures?	Yes; pictures of saints.
Do	52	M.	21	Why is he digging a hole?	He is not making a hole.
Do	12	M.	29	Is he digging a hole in which to bury the rabbit?	They don't put them under the earth.
Do	4	M.	30	Is he digging a hole in which to bury the rabbit?	I don't know what his intentions are.
Do	60	F.	16	Why is he digging a hole?	He wants to plant the flowers.
Do	49	F.	25	Is he digging a hole in which to bury the rabbit?	No; you can't see down the hole.
Do	73	F.	28	Is he digging a hole in which to bury the rabbit?	It may be that if they do not eat it.
Do	15	F.	31	Is he digging a hole in which to bury the rabbit?	I don't know whether he will bury the rat or whether he is playing.
Russian	10	M.	16	What are the boys and girl doing?	Attending the sheep.
				Have you seen pictures?	I have seen pictures only on religious subjects, images at home.
Do	25	M.	16	Have you seen pictures before?	I only saw pictures of saints and one picture book.
Do	1	M.	18	Why is he digging a hole?	Dog is dead; he wants to bury him.
Do	7	M.	18	What is the girl going to do with the flowers?	To plant.
Do	9	M.	33	Is he digging a hole in which to bury the rabbit?	May be.
Austrian Ruthenian	14	F.	16	Is he digging a hole in which to bury the rabbit?	I don't know.
Russian	23	F.	18	Have you seen pictures before?	My brothers have picture books; I look at them; I have seen pictures in other houses.
Austrian Ruthenian	15	F.	18	Is he digging a hole in which to bury the rabbit?	No.
Russian	5	F.	20	What is the big boy doing?	Looking at the bottle.
Do	19	F.	20	Is he digging a hole in which to bury the rabbit?	To reach water.
Austrian Ruthenian	21	F.	20	Why is he digging a hole?	I don't know. Is that hare asleep?
Do	2	F.	22		Poor peasants do not cover the grass with flowers.
Russian	2	F.	26	Is he digging a hole in which to bury the rabbit?	I don't know.
Do	12	F.	33	Why is he digging a hole?	Wants to bury the cat or the hat.
				Of what is this a picture?	Sheep, saints.

[1] The question, "Have you seen pictures?" was used occasionally in addition to the questions given above in order to clear up psychological points.

Among the *Slav illiterate* group the dead rabbit was called by the following names: Cat, 8; pig, 1; wolf, 1; dog, 2; lamb, 1; animal, 1.

TABLE 45.—*Statistical Results of Description Test (picture entitled "Last Honors to Bunny").*

Group.	Number examined.	Number of aliens giving collective idea, etc., in reply to question, "Of what is this a picture?" (Question No. 1.)			Number of aliens seeing point at different questions.							Number of aliens bringing out "grave idea," etc., in answering question, "What is the girl going to do with the flowers?" (Question No. 7.)			
		Collective idea.	Action.	Detail only.	Question No. 1.	Question No. 2.	Question No. 3.	Question No. 4.	Question No. 5.	Question No. 6.	Failures.	"Grave idea."	"Home idea."	Miscellaneous replies.	No answer.
Literate:															
9–11	12	1	7	4	2	4	.....	.....	4	2	...	7	3	1	1
Hebrew, 9–11	25	.....	10	15	1	1	.....	.....	13	9	1	6	4	15	.....
12–14	37	2	18	17	1	3	2	...	17	11	3	13	8	16	.....
15–above	100	10	52	38	6	13	5	4	38	28	6	48	16	33	3
Illiterate:															
10–11	4	1	.....	3	.....	1	.....	.....	1	.....	2	.....	1	[1] 3	.....
12–14	8	.....	4	4	.....	2	.....	.....	4	2	...	1	3	3	1
15–above	29	5	7	17	2	1	.....	.....	10	10	6	15	1	11	2
Italian—															
Men	20	3	6	11	.....	2	1	...	4	8	5	7	7	6	.....
Women	20	2	3	15	.....	1	1	...	5	9	4	5	3	[1] 12	.....
Slav—															
Men	10	.....	6	4	.....	1	1	...	6	1	1	1	2	7	.....
Women	30	.....	8	22	.....	.....	1	...	12	11	6	6	[2] 3	10	.....

[1] Includes 2 aliens who gave the "church idea."
[2] One alien, not included in these figures, gave a "grave" or "home" idea.

DISCUSSION.

Pictures are useful for the test of associating a visual impression with an auditory word memory or associating an auditory impression with a visual memory. Thus, the examiner may get the subject to name the different details of a picture as he points to them or the subject may be requested to point to the different details as the examiner names them. Range and quality of experiences on the part of the subject may be determined by this procedure.

All of the pictures were poorly described. It is obvious that the result obtained from the "Last Honors to Bunny" picture is entirely different from the result which would be obtained in the case of people other than arriving immigrants.

In order to interpret a picture correctly, the immigrant must be familiar with pictures of various kinds. He must also be experienced in the customs or events portrayed in a picture. In addition he must possess the power of constructive imagination. In other words, he can arrive at a situation portrayed in a picture only after analyzing and separately considering all the picture elements in the light of past experiences, then combining all these findings into the interpre-

tation. Good vision is also a necessary requisite in the performance of this test. The poor showing is due more often to a lack of experience with pictures and the scenes which they depict than to a lack of constructive imagination.

Among the 100 immigrants of the *literate 15 and above* group, a group wherein we would naturally expect to find the quickest and best interpretations, we find that only 6 immigrants gave the correct interpretation of "Last Honors to Bunny" picture at the first scrutiny; 38 did not interpret the picture until question 5 was reached; 26 did not succeed until question 6 was reached; and 6 did not catch the point or theme of the picture at all. The other groups of immigrants did not do as well in this test as the *literate 15 and above* group.

In many instances when questions 5 and 6 were reached and the immigrant saw the essential point of the picture for the first time, a smile came over his face.

The poor interpretations of the last picture were partly due to some of the following causes: Mistakes of details; took the rabbit for a cat, dog, goat, pig, etc. They had never seen pets treated well. They had never seen them treated with signal honors. Many are not accustomed to seeing rabbits used as pets. Peasants do not see well dressed children and sheep grazing at the same time. Whenever sheep are grazing and people are near-by, it usually means the people are attending the sheep. In certain places it is not customary to cover the grave of the dead with flowers. Even if an immigrant has had some experience with pictures, pictures of this kind are hard to interpret.

From a problem standpoint, it is well in testing to use pictures that portray certain native scenes with which peasants are more or less familiar.

COMPARATIVE SCORES OF ARRIVING IMMIGRANTS.

In order to show for comparative purposes what the different groups and individuals accomplished during these psychological studies, a system of scoring has been arranged for those tests which required little or no paraphernalia. The tests scored are already in use at many immigrant stations.

POINTS ALLOTTED TO EACH TEST.

The points given to each test are enumerated in the following table:

TABLE 46.—*Points allotted to each test.*

	Points.
Counting:	
2 to 20 by 2's	2
20 to 1	3
20 to 2 by 2's	4
3 to 30 by 3's	4
Total	13
Addition:	
3+4	1
6+6	1
6+7	1
8+6	1
15+15	1
15+16	1
2+3+4	1
2+4+6+8	2
17+13+9+4	3
Total	12
Division:	
20÷4	3
Problems:	
20−(3+4)	5
20−(2+7)	5
Total	10
Cube Test:	
10 movements	10
Obeying commands	5
Copying and drawing from memory:	
Diamond	3
Double trapezoid	3
Trapezoid	3
Interlocking figure	3
Total	12

	Points.
Healy:	
Trial 1	[1] 6
Trial 2	1
Total	7
Repeating digits	9
Opposites	8
Learning [2]	4
Days backward	2
Name of months	3
Arranging weights	2
Grand total	100

TOTAL SCORE MADE BY EACH IMMIGRANT TESTED.

The following table gives the total score made by each immigrant tested. For reference the nationality, race, immigrant's number among those of his nationality, sex, age, and amount of schooling (in years) are given. In each group the immigrants are arranged according to age.

TABLE 47.—*Total score made by each immigrant, with data as to nationality, sex, age, etc.*

Group.	Nationality.	Race.	Immigrant's No. among those of his nationality.	Sex.	Age.	Amount of schooling expressed in years.	Score.
Literate, 9–11	Italy	Italian, South	13	M.	9	3	96
	Norway	Scandinavian	1	F.	9	1½	73
	Italy	Italian, South	88	M.	10	2	83
	....do	....do	85	M.	10	1	73
	Denmark	Scandinavian	1	F.	10	4	93
	Turkey	Greek	9	F.	10	3	93
	Denmark	Scandinavian	2	M.	11	5	98
	Italy	Italian, North	72	M.	11	4	93
	....do	Italian, South	89	M.	11	3	73
	Russia	Polish	6	M.	11	1½	83
	Italy	Italian, North	70	F.	11	4	65
	Russia	Russian	13	M.	9	1	93
	....do	Hebrew	8	M.	9	5½	94
	....do	....do	34	M.	9	4	57
	....do	....do	36	M.	9	3	96
	....do	....do	22	M.	9	2	73
	....do	....do	5	M.	10	5	57
	....do	....do	30	M.	10	3½	98
	....do	....do	25	M.	10	3	93
	....do	....do	39	M.	10	3	93
	....do	....do	47	M.	10	3	73
Hebrew literate, 9–11.	Austria	....do	9	M.	10	2½	73
	Russia	....do	23	M.	10	2	73
	....do	....do	46	M.	10	½	73
	Austria	....do	31	F.	10	3	93
	Russia	....do	28	F.	10	2½	73
	....do	....do	29	F.	10	2	73
	....do	....do	33	F.	10	1	73
	....do	....do	38	F.	10	1	73
	....do	....do	11	F.	10	½	73
	....do	....do	42	F.	10	½	73
	....do	....do	17	M.	11	6	98
	....do	....do	48	M.	11	5½	98
	....do	....do	21	M.	11	4	93
	Rou nania	....do	49	M.	11	2	73
	Russia	....do	15	F.	11	1	73
	....do	....do	35	F.	11	½	73

[1] During the first trial, if the Healy Test is performed within the first 30 seconds, 6 points are allowed. If performed between 30 seconds and 60 seconds, 5 points are allowed; 4 points are allowed if it is performed between 1 and 2 minutes; 3 points are allowed if it be performed between 2 and 3 minutes; 2 points if it be performed between 3 and 4 minutes; and 1 point if between 4 and 5 minutes. At the second trial if it be performed within 30 seconds, 1 additional point is earned.

[2] If the immigrant succeeds in the Learning Test at trial 1, 4 points are given. If he succeeds at trial 2, 3 points are given; if at trial 3, 2 points; and if at trial 4, he obtains 1 point.

TABLE 47.—*Total score made by each immigrant, with data as to nationality, sex, age, etc.*—Continued.

Group.	Nationality.	Race.	Immigrant's No. among those of his nationality.	Sex.	Age.	Amount of schooling expressed in years.	Score.
Literate, 12-14	Italy	Italian, South	53	M.	12	5	89½
	Turkey	Hebrew	43	M.	12	5	95
	Norway	Scandinavian	3	M.	12	4	92
	Russia	Ruthenian	13	M.	12	3	89
	....do	Hebrew	37	M.	12	2	92
	Italy	Italian, North	97	F.	12	6	82
	Russia	Hebrew	41	F.	12	5	94
	Italy	Italian	21	F.	12	4	80
	....do	Italian, South	22	F.	12	3	77
	....do	.....do	92	F.	12	3	78
	....do	.....do	86	F.	12	2	84
	Russia	Hebrew	2	F.	12	½	79½
	....do	.....do	14	M.	13	6	92
	Austria	German	16	M.	13	6	75
	Greece	Greek	6	M.	13	5	96
	Italy	Italian, South	90	M.	13	4	73
	....do	.....do	28	M.	13	2½	83½
	Austria	Ruthenian	4	M.	13	1½	69
	Italy	Italian, North	71	F.	13	4	73½
	....do	Italian, South	31	F.	13	3	93
	Russia	Lithuanian	1	M.	13	1	63½
	Italy	Italian, South	98	F.	13	3	74
	....do	.....do	87	F.	13	2	83½
	....do	.....do	96	F.	13	2	76
	....do	.....do	2	F.	13	1	73½
	Russia	Hebrew	6	M.	14	6	94
	....do	.....do	45	M.	14	5	84½
	Austria	.....do	10	M.	14	4	83
	Russia	.....do	44	M.	14	4	96
	....do	Russian	8	M.	14	4	91½
	Italy	Italian, South	24	M.	14	2	79½
	Norway	Scandinavian	2	F.	14	7	95
	Italy	Italian, South	55	F.	14	4	85
	....do	.....do	99	F.	14	3	59
	....do	Italian	74	F.	14	2	69½
	Russia	Hebrew	3	F.	14	1	89
	....do	.....do	4	F.	14	1	72
	Italy	Italian, South	25	M.	15	8	87
	Russia	Hebrew	19	M.	15	7½	96
	....do	.....do	50	M.	15	3	93
	Italy	Italian	77	M.	15	1	82
	Russia	Ruthenian	10	M.	15	1	80
	Austria	German	10	F.	15	6	71
	Italy	Italian, north	51	F.	15	5	91
	....do	.....do	101	F.	15	5	88½
	....do	Italian, south	100	F.	15	4	86½
	Austria	Hebrew	12	F.	15	2½	89½
	Italy	Italian	65	F.	15	2	85
	Austria	Ruthenian	17	F.	15	1½	68
	Russia	Hebrew	40	F.	15	[1] 7	76½
	Turkey	Greek	7	M.	16	7	96
	Spain	Spanish	23	M.	16	3	57
	Russia	Russian	20	M.	16	2½	91
	....do	Hebrew	16	M.	16	2½	92
	Italy	Italian, north	18	M.	16	2	88½
Literate, 15 and above.	Ireland	Irish	1	F.	16	8	95½
	Norway	Scandinavian	4	F.	16	7	88½
	Austria	German	1	F.	16	6	89
	....do	.....do	11	F.	16	6	95
	....do	.....do	15	F.	16	6	88½
	Italy	Italian, south	102	F.	16	6	83
	Austria	Ruthenian	23	F.	16	3	89
	Greece	Greek	4	F.	16	2	82
	Italy	Italian	83	F.	16	2	82
	....do	Italian, south	91	F.	16	2	75
	....do	....do	30	M.	17	6	97
	Spain	Spanish	2	M.	17	3	91
	Russia	Russian	21	M.	17	3	90
	....do	.....do	3	M.	17	2	88
	Italy	Italian	75	F.	17	5	77
	Austria	Ruthenian	16	F.	17	3	88
	Russia	German	17	F.	17	3	71
	Italy	Italian, south	45	F.	17	3	72½
	Austria	Ruthenian	24	F.	17	2	89
	Spain	Spanish	8	F.	17	1½	69½

[1] Months.

TABLE 47.—*Total score made by each immigrant, with data as to nationality, sex, age, etc.*—Continued.

Group.	Nationality.	Race.	Immigrant's No. among those of his nationality.	Sex.	Age.	Amount of schooling as expressed in years.	Score.
Literate, 15 and above—Contd.	Russia	German	19	F.	17	1½	25
	....do	Hebrew	27	F.	17	1	24
	Germany	Polish	2	M.	18	7	48
	Greece	Greek	8	M.	18	6	47
	Russia	Hebrew	18	M.	18	4	46
	Italy	Italian, south	14	M.	18	3	45
	....do	....do	41	M.	18	2½	44
	....do	....do	8	M.	18	2	43
	....do	....do	29	M.	18	2	43
	Russia	Polish	1	M.	18	1½	42
	Spain	Spanish	19	M.	18	1	41
	Germany	German	21	F.	18	8	39
	Italy	Italian, south	20	F.	18	2	37
	Austria	Ruthenian	8	F.	18	1	36
	West Indies	Negro	3	M.	19	13	60
	Turkey	Armenian	1	M.	19	10	57
	Egypt	Egyptian	1	M.	19	9	56
	Greece	Greek	3	M.	19	5	52
	Italy	Italian, south	5	M.	19	4	51
	Austria	German	8	F.	19	1	36
	Russia	....do	20	M.	20	4	51
	Italy	Italian	67	M.	20	2	49
	....do	....do	78	M.	20	2	49
	....do	Italian, south	95	M.	20	2	49
	Austria	Hebrew	20	F.	20	3	38
	Algiers	Algerian	1	M.	21	6	53
	Austria	German	9	F.	21	6	40
	....do	Ruthenian	3	F.	21	5	39
	Italy	Italian, south	69	F.	21	2	37
	Russia	Russian	14	F.	21	2	37
	....do	....do	18	F.	21	1	36
	Switzerland	Swiss	1	M.	22	8	55
	Italy	Italian, south	39	M.	22	2	49
	West Indies	Negro	1	F.	22	8	43
	Austria	German	14	F.	22	8	43
	Italy	Italian, north	68	F.	22	3	38
	Russia	Lithuanian	2	F.	22	1	36
	Italy	Italian	63	F.	23	3	38
	....do	....do	80	F.	23	2	37
	Greece	Greek	10	M.	24	5	52
	Austria	German	3	F.	24	5	42
	Italy	Italian	46	F.	24	3	38
	....do	Italian, north	27	M.	25	2	49
	....do	Italian	43	M.	25	2	49
	Spain	Spanish	9	M.	26	2	49
	Russia	Russian	11	M.	26	1	48
	Austria	German	12	F.	27	8	43
	Russia	Hebrew	32	M.	27	5	52
	Spain	Spanish	11	M.	28	6	47
	Greece	Greek	1	M.	29	1	48
	Austria	German	4	F.	29	7	41
	Italy	Italian, north	47	F.	29	3	38
	Greece	Greek	11	M.	31	3	50
	West Indies	Negro	2	M.	31	2	49
	Spain	Spanish	1	M.	33	9	58
	Italy	Italian, north	26	M.	34	8	55
	Austria	German	5	F.	34	6	40
	Cuba	Cuban	1	M.	35	8	55
	Spain	Spanish	4	M.	36	9	56
	Austria	German	13	M.	36	4	51
	Spain	Spanish	10	M.	40	1	48
	Austria	German	2	F.	44	6	40
Illiterate, 10–11	Russia	Russian	16	M.	10	0	0
	....do	Hebrew	7	F.	11	0	0
	....do	....do	1	F.	11	0	0
	....do	Russian	11	F.	11	0	0
Illiterate, 12–14	....do	....do	26	F.	12	13	13
	Italy	Italian, south	32	M.	12	12	12
	Russia	Hebrew	26	F.	12	0	0
	Austria	German	7	M.	13	0	0
	Italy	Italian, south	16	M.	13	0	0
	....do	....do	94	M.	14	0	0
	....do	....do	44	F.	14	0	0
	Austria	Ruthenian	22	F.	14	0	0

[1] Months.

TABLE 47.—*Total score made by each immigrant, with data as to nationality, sex, age, etc.*—Continued.

Group.	Nationality.	Race.	Immigrant's No. among those of his nationality.	Sex.	Age.	Amount of schooling expressed in years.	Score.
Illiterate, 15 and above.	Spain	Spanish	13	M.	15	0	85
	Austria	Ruthenian	26	F.	15	0	45
	....do	German	6	F.	15	0	72
	Spain	Spanish	12	M.	16	0	82
	....do	....do	15	M.	16	1 3	76
	Greece	Greek	5	F.	16	0	60
	Spain	Spanish	14	M.	17	0	61
	Russia	Hebrew	13	F.	17	1 2	50½
	Spain	Spanish	17	M.	18	0	89
	....do	....do	21	M.	18	0	64
	Austria	Hebrew	24	F.	18	0	81
	Russia	German	18	M.	20	1 4½	88
	Syria	Arabian	1	M.	20	0	64
	Russia	Lithuanian	3	F.	22	0	63
	Greece	Greek	2	M.	23	0	78
	Spain	Spanish	20	F.	23	1 2	56½
	....do	....do	5	M.	25	0	86
	Roumania	Roumanian	1	F.	25	0	78
	Spain	Spanish	18	M.	27	0	65
	....do	....do	25	M.	30	0	76
	Italy	Italian, south	103	M.	31	0	62
	Spain	Spanish	6	M.	31	[2] 1	83
	....do	....do	16	M.	31	1 3	84
	....do[1]	....do	3	M.	32	0	62
	....do	....do	22	M.	39	0	88
	....do	....do	24	M.	42	0	77
	Italy	Italian	40	M.	43	0	76
	Spain	Spanish	7	M.	46	0	78
	Italy	Italian	17	M.	58	0	72
	....do	Italian, central	38	M.	16	0	63
	....do	Italian, south	84	M.	16	1 4	86
	....do	....do	6	M.	18	0	67
	....do	....do	9	M.	18	1 3	89
	....do	....do	93	M.	19	0	69½
	....do	....do	79	M.	20	0	81
	....do	....do	52	M.	21	0	78
	....do[2]	....do	34	M.	23	[2] 1	65½
	....do	....do	33	M.	24	1 5	81
	....do	....do	37	M.	24	[2] 1	87
	....do	....do	59	M.	25	0	82
Italian illiterate	....do	Italian	19	M.	27	0	78
	....do	....do	76	M.	27	1 5	85½
	....do	Italian, south	7	M.	29	0	75½
	....do	....do	12	M.	29	0	50½
	....do	....do	4	M.	30	0	35
	....do	....do	10	M.	30	0	91
	....do	....do	36	M.	30	[2] 1	83
	....do[4]	....do	35	M.	31	0	71
	....do	....do	11	M.	39	0	92
	....do	Italian, north	1	F.	16	0	56
	....do	Italian	60	F.	16	0	52

[1] Months.
[2] Month.
[3] The following remarks are to be found on the examination charts of certain immigrants. These remarks contain the general impression which the subject made upon the examiner.
34, Italian. "Perhaps a high-grade defective."
35, Italian. "Emotionally defective?"
42, Italian. "Not far from a high grade (mental defective). Some results point to normality and others point to defect."
54, Italian. "Defective, perhaps."
57, Italian. "Feeble-minded, perhaps."
9, Russia, Ruthenian. "Stupid, dull of comprehension, weeps at the end of the examination. It is hard to decide at this time whether this is a case of ignorance or mental deficiency."
11, Austria, Ruthenian. "Perhaps high-grade defective."
3, Spanish. "Results in some tests point to mental deficiency."
These immigrants are included among the normals, because a positive diagnosis could not be made in any of these cases at the termination of an examination which lasted one and one-half hours. Many similar cases are found during the mental examination of arriving immigrants, and it frequently requires a period of observation and three or four examinations before a diagnosis can be agreed to by two medical officers.
As stated in the introduction, a positive diagnosis of mental deficiency was made in three cases, whose records were excluded from the data of the investigation.
[4] Suspected case of mental defectiveness. (See footnote p. —.)

TABLE 47.—*Total score made by each immigrant, with data as to nationality, sex, age, etc.*—Continued.

Group.	Nationality.	Race.	Immigrant's No. among those of his nationality.	Sex.	Age.	Amount of schooling expressed in years.	Score.
	Italy	Italian, south	64	F.	16	(1)	
	do	Italian	23	F.	17	0	
	do	Italian, south	48	F.	17	0	
	do	do	56	F.	19	0	
	do	do	58	F.	19	0	
	do	do	42	F.	20	0	
	do	do	62	F.	20	0	
	do	do	81	F.	20	0	
Italian illiterate	do	do	82	F.	23	0	
	do	do	50	F.	24	0	
	do	do	49	F.	25	0	
	do[2]	do	54	F.	25	0	
	do[2]	Italian	57	F.	25	0	
	do	Italian, south	61	F.	25	0	
	do	do	73	F.	28	0	
	do	Italian, north	66	F.	29	[3]4	
	do	Italian, south	15	F.	31	0	
	do	do	3	F.	35	0	
	Russia	Russian	10	M.	16	[3]4	
	do	do	25	M.	16	0	
	Austria	Ruthenian	25	M.	16	0	
	Russia	Russian	1	M.	18	[3]3	
	do	do	7	M.	18	[3]5	
	do	Polish	5	M.	20	0	
	do[2]	Ruthenian	9	M.	22	0	
	Austria[2]	do	11	M.	24	0	
	Russia	Polish	7	M.	29	[3]5	
	do	Russian	9	M.	33	0	
	do	do	26	F.	12	[3]3	
	Austria	Ruthenian	22	F.	14	0	
	do	do	7	F.	16	[3]4	
	do	do	14	F.	16	0	
	Russia	Polish	11	F.	17	0	
	do	Russia	4	F.	17	0	
	do	Polish	8	F.	17	(1)	
	Austria	Ruthenian	19	F.	17	0	
	Russia	Polish	4	F.	18	0	
Slav illiterates	do	Russian	22	F.	18	0	
	do	do	23	F.	18	0	
	Austria	Ruthenian	1	F.	18	0	
	do	do	6	F.	18	0	
	do	do	15	F.	18	[3]3	
	Russia	Russian	15	F.	19	0	
	do	do	5	F.	20	0	
	do	do	6	F.	20	[4]6	
	do	do	19	F.	20	0	
	Austria	Ruthenian	18	F.	20	0	
	do	do	20	F.	20	0	
	do	do	21	F.	20	0	
	do	Polish	3	F.	21	0	
	do	Ruthenian	2	F.	22	0	
	do	do	5	F.	23	0	
	Russia	Polish	9	F.	24	0	
	do	Russian	2	F.	26	0	
	do	do	24	F.	27	[3]3	
	do	Ruthenian	12	F.	32	0	
	do	Russian	12	F.	32	0	
	do	Polish	10	F.	35	0	

[1] Few months.
[2] Months.
[3] Suspected case of mental defectiveness. (See footnote p. —.)
[4] Weeks.

DISCUSSION.

In order to compare the result of an examination with the score obtained in this investigation, the examination must be conducted in a quiet room in the presence of no one but interpreter and examiner. Twenty-four hours at least must intervene between the time of the immigrant's arrival and the examination, and the method of the examination must follow as closely as possible the method employed in this investigation. In order to confirm or disprove the result of any test of this investigation, it is important that the subject be put through a five-minute period of preliminary questioning before the test in question is propounded.

It is well to remember that during the experiment the most intelligent subjects failed on certain tests and that many immigrants who made a low general average made an excellent showing with some of the tests.

The complete examination as conducted in this experiment has been found to be a severe strain on children under 10 years of age. Many such children are also inaccessible at a first examination. Even those who reply to questions and attempt to perform tests are disturbed and do not do themselves entire justice when first examined. A seemingly inaccessible child may cooperate after seeing others perform tests and answer questions.

The medical examiner planning to familiarize himself with the psychology of immigrant children is advised first to test young children of different races in counting, simple addition, identifying objects, repeating digits, and performing the cube test in order to get a general idea of the normal child mind at the time of landing. Such tests will assist the examiner in understanding the child's mental intent, his manner of thinking, his emotional reaction, and his cooperative power.

The examination chart of each immigrant tested together with tabulations showing the correlations in all tests for each individual are on file at Ellis Island. They may be inspected at any time by medical officers and others interested in the subject.

BIBLIOGRAPHY.

Psychology. By William James. Henry Holt. N. Y. 1908.

Handbook of Mental Examination Methods by Shepherd Ivory Franz. Ph. D. The Journal of Nervous and Mental Disease Publishing Co. 1912.

A Method of Measuring the Development of the Intelligence of Young Children. By Alfred Binet and Th. Simon. authorized translation by Clara Harrison Town, Ph. D. Chicago Medical Book Co. 1913.

The Psychology of Efficiency. By Henry Alford Ruger, Ph. D. The Science Press. New York. 1911.

Association Tests. By R. S. Woodworth and Frederick Lyman Wells. Psychological Review Co. Princeton, N. J. Dec., 1911.

Manual of Mental and Physical Tests. By Guy M. Whipple, Warwick and York. Baltimore. 1911.

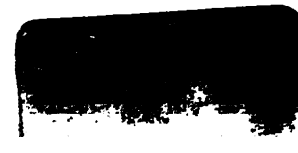
Education. By Edward L. Thorndike.

192

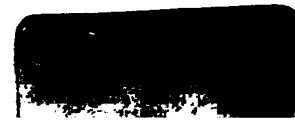
O

SEP 1968

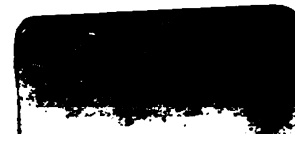
SEP 1968



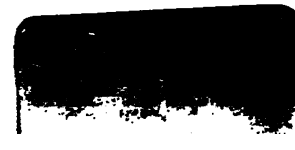
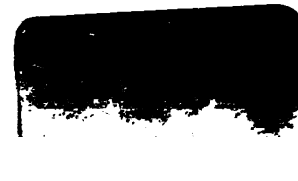
SEP 1968



SEP 1968



SEP 1968



SEP 1968